

THE
ANATOMY
OF
Humane Bodies
EPITOMIZED.

WHEREIN

All the *PARTS* of Man's Body, with
their *ACTIONS* and *USES*, are suc-
cinctly described, according to the newest
Doctrine of the most Accurate and Learn-
ed Modern Anatomists.

*The Fifth Edition, Corrected and Enlarged both in
the Discourse and Figures.*

By *THO. GIBSON*, M. D. Fellow of
the College of Physicians, *London*.

L O N D O N,

Printed by *T. W.* for *Awnsham* and *John Churchill*,
at the *Black Swan* in *Pater-noster-Row*, 1697.



TO THE
READER.

INSTEAD of *bespeaking* the Reader's Candour, (as is common with Authors) I have the pleasanter task of *boasting* of it: for to *that* only is it owing, that this Book which deserved not a *Second Impression*, has now past a *Fifth*. And I hope those who have been so kind as to buy off the *former*, will not reckon it for a Fault, that *This* pretends to be more correct and complete than they; for to have continued the known Errours and Imperfections thereof, would have been an Injury both to the Reader, and my self: *To the Reader*, in obtruding acknowledged Errours, and concealing new Discoveries; And *to my self*, in giving occasion to be thought negligent in what I have taken so great pains in, and ignorant of what I know.

To the Reader.

But my publishing this Book now a *Fifth* time in *English*, needs a better Apology than I can give: Only this I can say. That though it speak English, yet none shall well understand it, that is a stranger to the more learned Languages: And therefore it disdains the Conversation of Quacks and old Women, leaving them to meditate on the traditional Virtues of their Receipts, without offering to instruct them in *the Knowledge of themselves*, of which their Ignorance and Impudence render them incapable in any sense.

Its Ornaments indeed are in a great measure borrow'd, but it fears not the Fate of the *Daw* in the Fable, to be unplum'd and laugh'd at; because they are not *furtivi colores*, seeing it struts not in them as its own, but has every where the ingenuity to confess the true Owners, whom if the Reader desire to know, it here presents him with a List of the Principal.

Adrian.

To the Reader.

Adrian. Spigelius de *Humani Corporis fabrica*.

Isbrandi de Diemberbroeck *Anatome corporis humani*.

Thomæ Bartholini *Anatome*.

D. Willifius de *Cerebro*.

---- *Exercitationes Medico-physicae duæ*, 1. De *Sanguinis accensione*, 2. De *motu Musculari*.

---- De *primis viis & de respirationis organis* in his first and second part of his *Pharmaceutice Rationalis*.

Dr. Highmore's *Corp. hum. disq. Anatomica*.

M. Malpighii *Epistola Anatomica de Cerebro, Lingua, Tactus organo*.

---- De *viscerum structura*, viz. *Hepatis, Cerebri corticis, & Lienis*.

---- *Exercit. de Omento, Ping. & Adip. duct.*

Nicolai Stenonis *Dissertatio de Cerebri Anat.*

--- De *Musculis & Glandulis Observationum specimen*.

---- De *Glandulis Oris, & novis earundem vasibus Observationes Anatomicae*.

Caroli Fracassati *Dissertatio Epistolica de Cerebro*.

Dr. Lower's *Tractatus de Corde*.

Dr. Glisson's *Tractatus de Ventriculo & Intestinis*.

---- *Anatomia Hepatis*.

Dr. Charlton's *Enquiries into Humane Nature in IV. Anatomick Prelections in the New Theatre of the Royal College of Physicians in London*.

To the Reader.

Dr. Wharton's *Adenographia, sive Glandularum totius corporis descriptio.*

Lamb. Velthufii *Traëtatus duo Medico-physici, unus de Liene, alter de Generatione.*

Dr. Harvey's *Exercitationes Anatomicae de Cordis motu, & circulatione Sanguinis.*

---- *Exercitationes de generatione Animalium.*

Casp. Bartholin. (Thom. F.) *Diaphragmatis structura nova.*

Francisci Stockhamer, *Doëtoris Medici & Anatomici Microcosmographia.*

Laurentii Bellini *Exercitatio Anatomica de structura & usu Renum.*

Dr. Grew's *Comparative Anatomy of Stomachs and Guts, subjoined to his Museum Regalis Societatis.*

Anton. Nuck de *ductu salivali novo, saliva, ductibus Oculorum aquosis, & humore aqueo.*

Gualt. Nedham *Disquisitio Anatomica de formato fœtu.*

Joh. Conr. Peyer's *Parerga Anatomica & Medica, viz. de Glandulis Intestinalibus, &c.*

Joh. Conrad. Brunner's *Experimenta nova circa Pancreas.*

Dr. Mayow's *Traëtatus quinque Medico-physici, &c.*

Regneri de Graef *Opera omnia.*

Johannis Swammerdami *Miraculum Naturæ, sive Uteri Muliebris fabrica.*

Joh. Alph. Borelli *Opus posthumum de motu Animalium.*

Frederici Ruyschii *responsiones ad D. Joh. Gaubium,*

To the Reader.

Gaubium, & Joh. Jac. Campdomercum.
Dr. H. Ridley's Anatomy of the Brain.
Dr. Brigge's Ophthalmographia, sive Oculi
ejusq; partium Descriptio Anatomica.
Dr. Cole's Cogitata de secretione Animali.
Dr. Croone de ratione motûs Musculorum.
Monf. du Verney of the Ears.
Dr. Henshaw's Aero-Chalinos.
Monf. Perrault Essays de Physique, &c.
Steph. Blancardi Anat. Reformata.
Dr. Havers's Osteologia nova.
Mr. Cowper's Appendix to his Myotomia re-
formata.

These, I say, are the Authors which have chiefly adorned this *Book*, several whereof were not sought to in the former Editions; and those that were, have now (some of them) been much more liberal in contributing their Symbols to make it more complete.

As it is, if it may assist the memory of such as are well skill'd in Anatomy, or instruct and direct the young Beginner, I have not miss'd of my Design.

Farewell.

THE

THE CONTENTS.

The Introduction.

à p. i. ad vi.

Book I.

Of the lowest Cavity called *Abdomen*.

CHAP. I. *Of the division of the whole Body,
and of its Parts.* Page 1.

II. *Of the circumscription, regions, and parts of the
Abdomen.* 5

III. *Of the common containing parts of the Belly* 9

IV. *Of the proper containing parts.* 18

V. *Of the Omentum.* 22

VI. *Of the Gullet.* 31

VII. *Of the Ventriculus or Stomach.* 34

VIII. *Of the Intestines or Guts.* 45

IX. *Of the Mesentery.* 60

X. *Of the Venæ lactææ, Glandulæ lumbaræ, Re-
ceptaculum commune, Ductus chyloferus tho-
racicus, and of the motion of the Chyle.* 66

XI. *Of the Liver.* 73

XII. *Of the Vena portæ.* 82

XIII. *Of the Vena cava dispersed within the Abdo-
men.* 89

XIV. *Of the Gall-bladder and Porus bilarius.* 93

XV. *Of the Pancreas.* 100

XVI. *Of the Spleen.* 105

XVII. *Of the Kidneys and the Glandulæ renales.* 121

XVIII. *Of*

The Contents.

XVIII. <i>Of the Ureters.</i>	135
XIX. <i>Of the Bladder.</i>	137
XX. <i>Of the Vasa præparantia in Men.</i>	141
XXI. <i>Of the Stones or Testicles, the Scrotum, and the Epididymidæ.</i>	144
XXII. <i>Of the Vasa deferentia, Vesiculæ seminales and Prostatae.</i>	153
XXIII. <i>Of the Tard.</i>	160
XXIV. <i>Of the Vasa præparantia in Women.</i>	171
XXV. <i>Of Womens Testicles or Ovaria.</i>	173
XXVI. <i>Of the Vasa deferentia in Women, or their Oviducts.</i>	177
XXVII. <i>Of the Uterus or Womb, and its Neck.</i>	182
XXVIII. <i>Of the Vagina, and its Contents, viz. the Hymen, and Carunculæ myrtiformes.</i>	190
XXIX. <i>Of the Pudendum muliebre, or Woman's Privity.</i>	195
XXX. <i>Of a Conception.</i>	201
XXXI. <i>Of the Placenta uterina, or Womb-liver, and Acetabula.</i>	213
XXXII. <i>Of the Membranes involving the Fœtus, and of the humours and air contained in them.</i>	217
XXXIII. <i>Of the Umbilical Vessels, and of the nourishing of the Fœtus.</i>	224
XXXIV. <i>What parts of a Fœtus in the Womb differ from those of an adult person.</i>	240
XXXV. <i>Of the Birth.</i>	244

Book II.

Of the middle Cavity called *Thorax*.

CHAP. I. <i>Of the common containing parts of the Thorax, or Breast.</i>	Page 249
II. <i>Of the proper containing parts; and first of the Dugs.</i>	

The Contents.

<i>Dugs.</i>	250
III. <i>Of the internal proper containing parts, viz. the Pleura, Mediastinum, and Diaphragma.</i>	p. 263
IV. <i>Of the Pericardium, and the humour contained in it.</i>	276
V. <i>Of the Heart, in general, and of the reason of its motion.</i>	279
VI. <i>Of the Pulse, and the circulation of the Blood.</i>	286
VII. <i>How Blood is made of Chyle, of its Heat and Colour, and whether the Body be nourished by it.</i>	294
VIII. <i>Of the parts of the Heart, viz. the Auriculæ, the Ventracles, and the Septum that divideth them.</i>	303
IX. <i>Of the ascending Trunk of Vena cava.</i>	307
X. <i>Of Vena arteriosa, and Arteria venosa.</i>	316
XI. <i>Of the Aorta, or great Artery.</i>	319
XII. <i>Of the Aspera Arteria and Lungs.</i>	335
XIII. <i>Of Respiration.</i>	344
XIV. <i>Of the Neck, and the parts contained in it, viz. the Larynx, Pharynx, Tonfillæ, &c.</i>	353

Book III.

Of the highest Cavity, or Head.

CHAP. I. <i>Of the Head in general, and its common containing parts.</i>	Page 359
II. <i>Of the Hair.</i>	361
III. <i>Of the proper containing parts.</i>	364
IV. <i>Of the Brain in general.</i>	370
V. <i>Of the manner of dissecting the Brain: of the Brain properly so called, the Fornix, Septum, and the three Ventracles.</i>	374
VI. <i>Of</i>	

The Contents.

VI. <i>Of the Medulla oblongata, and its fore-parts, viz. Crura, Corpora striata, Nervorum optico- rum thalami, Nates and Testes, with the Vulva and Anus; as also of the Glandula pinealis, Plexus choroides, and Infundibulum.</i>	378
VII. <i>Of the Cerebellum, and the fourth Ventricle; as also of the hinder-part of the Medulla oblonga- ta, of the Rete mirabile, and Glandula pitui- taria.</i>	384
VIII. <i>Of the Spinalis medulla.</i>	392
IX. <i>Of the action of the Brain, and the (supposed) Succus nutritius of the Nerves.</i>	394
X. <i>Of the Nerves arising within the Skull; and first, of the first and second pairs.</i>	401
XI. <i>Of the third and fourth pairs.</i>	406
XII. <i>Of the fifth, sixth, and seventh pairs.</i>	408
XIII. <i>Of the eighth, ninth, and tenth pairs.</i>	412
XIV. <i>Of the Nerves of the Spinalis medulla; and first, of the Nerves of the Neck.</i>	423
XV. <i>Of the Nerves of the Vertebræ of the Thorax.</i>	427
XVI. <i>Of the Nerves of the Vertebræ of the Loins.</i>	429
XVII. <i>Of the Nerves which arise from the marrow of Os sacrum.</i>	431
XVIII. <i>Of the Face and its parts.</i>	434
XIX. <i>Of the Eyes in general, and their outward or containing parts.</i>	436
XX. <i>Of the Tunicles of the Eye.</i>	440
XXI. <i>Of the humours and vessels of the Eye.</i>	442
XXII. <i>Of the Auricula.</i>	446
XXIII. <i>Of the inward part of the Ear.</i>	448
XXIV. <i>Of the Nose.</i>	455
XXV. <i>Of the external parts of the Mouth.</i>	458
XXVI. <i>Of the inner parts of the Mouth.</i>	459

The Contents.

Book IV.

Containing a description of the Veins, Arteries, and Nerves of the Limbs: with an Appendix of the Glands thereof.

C H A P. I. Of the Veins of the Arm.	Page 469
II. Of the Arteries of the Arm.	471
III. Of the Nerves of the Arm.	472
IV. Of the Veins of the Thigh, Leg, and Foot.	473
V. Of the Arteries of the Thigh, Leg, and Foot.	Ibid.
VI. Of the Nerves of the Thigh, Leg, and Foot.	474

An Appendix to Book IV.	475
-------------------------	-----

Book V.

Containing a Treatise of all the Muscles of the Body.

C H A P. I. Of a Muscle in general, and of its parts.	Page 477
II. Of the differences and action of the Muscles.	484
III. Of the Muscles of the Eye-lids and Forehead.	487
IV. Of the Muscles of the Eyes.	489
V. Of the Muscles of the Nose.	492
VI. Of the Muscles of the Lips and Cheeks.	494
VII. Of the Muscles of the lower Jaw.	496
VIII. Of the Muscles of the Ear.	499
IX. Of the Muscles of the Tongue.	502
X. Of the Muscles of the Bone of the Tongue, called Os hyoides.	503

The Contents.

XI. <i>Of the Muscles of the Larynx.</i>	505
XII. <i>Of the Muscles of the Uvula, Palate, and Throat.</i>	508
XIII. <i>Of the Muscles of the Head.</i>	509
XIV. <i>Of the Muscles of the Neck.</i>	512
XV. <i>Of the Muscles of the Thorax.</i>	513
XVI. <i>Of the Muscles of the Back and Loins.</i>	516
XVII. <i>Of the Muscles of the Abdomen.</i>	518
XVIII. <i>Of the Muscles of the Genitals, both in Men and Women.</i>	523
XIX. <i>Of the Muscles of the Bladder and Anus.</i>	524
XX. <i>Of the Muscles of the Scapula or Shoulder-blade.</i>	525
XXI. <i>Of the Muscles of the Arm.</i>	527
XXII. <i>Of the Muscles of the Ulna.</i>	530
XXIII. <i>Of the Muscles of the Radius.</i>	532
XXIV. <i>Of the Muscles of the Wrist.</i>	534
XXV. <i>Of the Muscles of the Palm of the Hand.</i>	535
XXVI. <i>Of the Muscles of the four Fingers.</i>	537
XXVII. <i>Of the Muscles of the Thumb.</i>	540
XXVIII. <i>Of the Muscles of the Thigh.</i>	542
XXIX. <i>Of the Muscles of the Leg.</i>	545
XXX. <i>Of the Muscles of the Foot or Tarsus.</i>	548
XXXI. <i>Of the Muscles of the Toes.</i>	551

Book VI.

Of the Bones.

C H A P. I. <i>Of Bones in general, their constituent and integral parts.</i>	Page 559
II. <i>Of the different conjunctions of Bones one to another.</i>	567
III. <i>Of the Skull in general.</i>	570
IV. <i>Of</i>	

The Contents.

IV. <i>Of the Sutures of the Skull.</i>	P. 572
V. <i>Of the proper Bones of the Skull.</i>	574
VI. <i>Of the Bones common to the Skull and upper Jaw.</i>	578
VII. <i>Of the upper and lower Jaws.</i>	582
VIII. <i>Of the Teeth.</i>	584
IX. <i>Of the Bone of the Tongue called Os Hyoides.</i>	589
X. <i>Of the Bones of the Neck, viz. the Claviculæ and Vertebrae.</i>	590
XI. <i>Of the Vertebrae of the Thorax.</i>	594
XII. <i>Of the Ribs.</i>	595
XIII. <i>Of the Breast-bone or Sternum.</i>	597
XIV. <i>Of the Vertebrae of the Loins.</i>	599
XV. <i>Of the Os sacrum, and Os Coccygis or Rump-bone.</i>	600
XVI. <i>Of the Ossa innominata.</i>	601
XVII. <i>Of the Scapula or Shoulder-blade.</i>	604
XVIII. <i>Of the Os humeri or Shoulder-bone.</i>	605
XIX. <i>Of the Bones of the Cubit.</i>	607
XX. <i>Of the Bones of the Hand.</i>	608
XXI. <i>Of the Thigh-bone, and Patella.</i>	611
XXII. <i>Of the Bones of the Leg.</i>	613
XXIII. <i>Of the Bones of the Tarsus.</i>	615
XXIV. <i>Of the rest of the Bones of the Foot.</i>	617

An Appendix to Book VI.

C H A P. I. <i>Of a Cartilage.</i>	621
II. <i>Of a Ligament.</i>	623
III. <i>Of the Nails.</i>	625

T H E

THE Introduction.

ANATOMY is the artificial separation of the Parts of the Body by section, instituted for the attaining to the knowledge of its Frame, and the use of each Part. *Anatomy what.*

All animal Bodies of convenient bulk, are the *Its Sub-* Subject of Anatomy: But an humane Body is the *ject,* primary, both because its frame is more perfect and exquisite than that of any other, and because the Anatomist dissects others, to the end only that by comparing those with this, he may obtain a more accurate knowledge of it, the preservation and cure whereof is the principal and ultimate End of Anatomy.

and Ends

This Art being so noble for its *Subject*, and so beneficial for its *End*; as many as have taken pains in cultivating of it, have deserved very well of Mankind: for Skill therein, as it is very pleasant and satisfactory unto all, so is it absolutely necessary for such as take upon them to administer Medicin, or practise Chirurgery. But the *Minima* or smallest particles, whereof the parts of our Bodies consist, being so very fine, that many of them cannot be discovered by the naked eye, and some deny to shew themselves to the best Glasses that have yet been invented, 'tis no wonder that there have been and still continue various Opinions concerning the nature of several parts, and consequently of their actions and uses, and the man-

*The Fa-
brick of
the Body
consists of
parts simi-
lar and
dissimilar.*

ner and reason of them. But the unwearied diligence of some later Anatomists hath brought many things to light, wherein all Antiquity was mistaken; whose discoveries, collected with the greatest care, I shall insert (with due commemoration of the Authors) in their proper places in this Treatise. Before our entrance whereupon, I think it necessary, by way of *Introduction*, first to explain to the young Student in Anatomy, what those *similar* parts are that the bulk of the Body consists of; that when *dissimilar* parts which consist of them, are described, he may the better understand what is said.

*Similar
parts what.*

And first we must explain what is meant by *similar* and *dissimilar* parts. A *similar* (otherwise called a *simple*) part, is that which though it be cut or divided into several pieces, yet they will be all of the same nature, substance and denomination with one another, and with the whole: as every portion or particle of a *Bone* (v. g.) is *Bone*. A *dissimilar* (otherwise called a *compound*, and an *organical*) part, is that whose portions are neither of the same substance, nor denomination; as (v. g.) a *Finger*, which consists of the skin, flesh, bone, &c.

*Dissimilar
what.*

Of this latter kind of parts, this is no proper place to treat: And as concerning the former, the Reader must understand, that though they be called simple or similar, 'tis not meant that they are *truly* so: (for there are none amongst those we term so, whose least particles are not of different natures and kinds;) but that they appear so to the more superficial and slight view of the Anatomist; and to distinguish them from the compound or dissimilar parts, whose diversity of substance the eye at the first glance discovers.

These

These similar parts are commonly reckon'd to be Ten, viz. the *Skin*, a *Membrane*, *Flesh*, a *Fibre*, a *Vein*, an *Artery*, a *Nerve*, a *Ligament*, a *Cartilage*, a *Bone*. These are common to the whole Body, there being no dissimilar or organical part which does not consist of several of them. There are besides these, other parts which may also be called similar as to their substance; but because they are proper only to some particular part, 'twill be more convenient to treat of them when we come to such part: and therefore we shall omit to speak of them here, and confine our selves to the parts mention'd.

The word *Skin*, though in a large and vulgar acception it be applied to the Membranes of the Muscles, &c. (as we commonly say such a piece of flesh is *skinny*) yet Anatomists understand it only of the outward integument or cover of the Body, which the *Latins* term *cutis*.

The word *Membrane* is a common appellation to all the coverings that invest the solid parts of the Body, or contain the fluid humours. Thus the Bones, Muscles, Brain, &c. are cloathed with membranes; and the gall, humors of the eye, &c. contained in them.

Flesh is an uncertain term, unless some restrictive explication be added to it, to limit its being meant of this or that particular sort of flesh; there being four sorts of it, viz.

1. That of the *Muscles*, which most properly bears the name; and comprehends all the red, solid (yet soft) substance, that the bulk of the Body chiefly consists of; which shall be further described in the *fifth Book*.

2. That of the *Viscera* or *Bowels*, viz. of the Liver, Spleen, and Kidneys, of which in the *first Book*,

B 2

3. Mem-

Similar
parts are
Ten.

I.
The Skin.

II.
A Mem-
brane.

III.
Flesh, four
sorts of it.

1.
Muscular.

2.
Viscerous.

3.
Membranous.

3. *Membranous* flesh, that namely which is partly membranous, and partly fleshy, as the substance of the Gullet, Stomach, Intestins, Womb, Bladder, and the *Membrana carnosæ* (so called) itself; of all which more afterwards in their proper places.

4.
Glandulous.
Glands of two kinds.
1. Conglobate.

4. That of the *glands* (or kernels.)

The *Glands* in respect of their *conformation*, are usually divided into *conglobate*, and *conglomerate*; and these have a different *use* the one from the other. 1. The *conglobate* are smooth in their surface, and are made up of one continued substance as it were: the *use* whereof is to separate the *lymphæ* from the arterial blood, and to remand it by the *Lympheducts*, either into the chyliiferous, or sanguiferous vessels (only those in the *Mesentery*, as likewise those in the *Breasts* of *Nurses*, are thought to minister to the chyle, as well as to the *lymphæ*.) 2. The *conglomerate* are somewhat uneven in their surface, and consist each as it were of many lesser glands: and their *use* is, to separate from the blood, and also to elaborate and alter, several sorts of juices, and then by one or more proper ducts to convey the same into peculiar cavities. As the *Parotides* and maxillar glands convey the *salivæ* into the mouth by their salival ducts, &c.

IV.
A Fibre.

A *Fibre* is defined by Dr. Glisson (in cap. 4. de *Ventric.*) to be a body in figure like a thread, slender, tenacious, tensile, and irritable, made of *spermatical matter*, for the sake of some motion and strength. They are of two sorts, *fleshy*, and *nervous*: The first constitute a great part of the *Muscles*, and are tubular, filled with a fluid (of which see more *Book V. Chap. I.*) and are the main instruments of motion: The latter (being also tubular, as some think) run through, and are

interwoven

interwoven in the nervous parts, and are the principal organs of sense: being otherwise called *membranous fibres*, when they are interwoven in Membranes.

A *Vein* is a sanguiferous vessel, whose larger branches in the habit of the body, especially in the limbs, run next under the skin, and both there and also in the Venters (*viz.* belly, breast and head) serve to convey back again towards the heart, that blood which was sent from thence by the Arteries into the respective parts. They are of a thinner substance and looser texture than the Arteries: and of a like nature with them (only finer) are the milky veins that convey the chyle, and also the peculiar ducts that discharge the particular humors from the conglomerate glands; and somewhat finer yet are the Lympheducts that return the *Lympha* separated from the arterial blood by the conglobate glands.

V.
A Vein.

An *Artery* is also a sanguiferous Vessel, and generally holds the same course with a Vein, but lies deeper. It can no where be seen in the surface of the body, but may be felt to beat in several parts at the same time with the heart; and its pulse is chiefly indicative of the temper of the blood, but partly also of the vigor or defect of spirits. Its coat is stronger and more fibrous and dense than that of a Vein. Its use is, to convey blood and vital spirit into all the parts, for their nourishment, and the conservation of their innate heat.

VI.
An Artery.

The *Nerves* are vessels taking their origine from the medullar substance of the brain (taken largely) and the spinal marrow, conveying thence animal spirits into all the parts, for their sense and motion respectively. They are without any such sensible cavity or humor flowing therein, as the Veins and Arteries have; and consist of a double

VII.
A Nerve.

coat derived from the two membranes that cloath the brain, and a medullar substance contained therein. Their divisions and distributions do not correspond with those of the Veins and Arteries, nor have they one common trunk from whence all the rest are propagated, as those have, but spring each from its particular root; unless one will call the *medulla oblongata* continued into the *spinalis*, a Nerve, and so make it the common trunk.

VIII.
A Ligament.

A *Ligament* is a part of a middle substance betwixt a Cartilage and a Membrane, appointed for the tying of sundry parts together. Those which tye the bones to one another are void of sense, but those that knit other parts together are (dully) sensible.

IX.
A Cartilage.

A *Cartilage* (or Gristle) is of a middle substance betwixt a Ligament and a Bone. It is flexible, but insensible: and by the drying up of its moist glutinous particles, in age it often degenerates into bone: whence, in a great measure, is the stiffness in the joints of old men, most of the ends of the bones in their articulations with one another being tipped with cartilages, which in age also grow bony.

X.
A Bone.

A *Bone* is a very dry, cold and hard part, inflexible, void of sense, affording stabilitment and form to the whole body. Some bones are more spongie and porous, and others more solid. Others again have large cavities, filled with marrow; others none. But of these, and all the other similar parts, more in their proper places.

Thus much I thought good to premise by way of *Introduction*, to make the Reader more capable of receiving both delight and benefit in perusing this Anatomical Treatise, to which I now proceed.

The First Book.

OF THE
LOWEST CAVITY,
CALLED
ABDOMEN.

CHAP. I.

*Of the Division of the whole Body, and of
its Parts.*

AN humane Body may be considered either *The Body*
generally, with respect to the whole; or considered
particularly, with respect to each part of in two re-
spect^s.
which it consists.

In its *general* consideration there are to be taken notice of, its external form or shape, its bulk, and its colour. But these Accidents being obvious to the eye of every man, as well as to the Anatomist's, are no proper subjects for our discourse. *1. Gene- rally.*

The *particular* consideration of it observes and describes the figure, connexion and composition or structure of each several part, and the great diversity of their actions and uses. *2. Particu- larly.*

The whole Body is divided into the Trunk, (con- *The division*
taining three Ventrers) and the Limbs. The three *of the whole*
Ventrers *Body.*

Venters are the Cavities of the *Abdomen* or Belly, the Chest, and Head. The *Limbs* are the Arms, Thigh and Legs.

A part
defined.

A *Part* may be thus defined, *viz.* It is a bodily or solid Substance, cohering with, making up, and partaking of the life of, the whole, and serving for some function, or use.

In this definition are implied these five things.

1. A part must be *solid*, whereby the spirits and humors are excluded.

2. It must *cohere* with the whole, that is, be not only contiguous, but continuous to it: and from hence also the spirits and humors are excepted, as only touching the sides of the vessels as they pass along, being contained in them, but not united to them.

3. It (with others) must serve to *complete* or *make up* the whole. Whence the Child in the womb is not to be reckoned a part of a pregnant woman, though it be knit to her womb by the Navel-string (the *placenta* intervening) because after delivery she remains a perfect woman, as she was also before conception.

4. It must partake of the *life* of the whole: whereby the nails and hairs are exempted, which have only a vegetative, but no animal life.

And 5. It must have some *function*, or *use*: so that preternatural excrescencies, as Warts, &c. are not to be reputed parts, (being also excluded by the third head, as contributing nothing to the perfection of the whole.)

Having mentioned the *function*, and *use* of a part, it will be convenient to explain what is meant by them, and to distinguish them.

The function of a part what.

The *function* (or *action*) of an (organical) part, is a certain effective or operating motion produced by it,

it, from its own proper aptitude. And is either *private*, or *publick*. By the *private* action the parts only provide for themselves; but by the *publick*, for the whole animal. As for instance: The stomach by a *private* action converts the blood that is brought to it by the Arteries, into its own nourishment: But by its *publick* action, which is Concoction, or turning the food into Chyle, it provides for the whole body.

The *use* of a part is that assistance which the less principal parts afford to the principal one in performing its action. And it differs from the *action* of a part in two respects. *First*, In that those parts only are said to have an *action*, which operate; whereas many have an *use*, which act nothing at all themselves, but only accommodate and assist those that do act. Thus the Fat has no *action* of its own, but it is *useful* to cherish and moisten the Muscles, &c. that their motion or action may be performed more glibly and easily. *Secondly*, An *action* belongs to or proceedeth from the whole organ that operates; but every particular part that makes up the organ, hath an *use*. Thus the whole Muscle exerts its *action*, which is contraction: But the several parts of which a Muscle consists, have each of them their *use* to assist this action; as, the Membrane that invests it, is of use to inclose and contain its fibres, and to distinguish and keep it apart from other Muscles; the use of the Nerve is to bring it animal spirits; of the Artery, to supply it with blood, &c. But because the *action* of a less principal part, may be of *use* to further that of one more principal; as also because the *action* of several organs may conspire to one *use* (as the Muscles of the Abdomen, to the exclusion of the excrements) therefore *action* and *use* are often confounded, and used

It is twofold, private and publick.

The use of a part what, and wherein it differs from the action.

used the one for the other by Anatomists; nor shall we every where in the following Tract distinguish them so nicely.

The division of the parts.

The *parts* of the *body* have a *twofold* difference or distinction; the one from their *matter*, and the other from their *function*, or *end*.

1. From their *matter*.

In respect to the *matter* of which they consist, they are divided into *similar* and *dissimilar*, of which we have treated fully enough before in the *Introduction*.

2. From their *function*, or *end*, viz. into *organical*,

In respect of their *function*, or *end*, they are divided into *organical*, and *non-organical*.

An *organical* part is that which is designed for performing some action. Such as are chiefly the *dissimilar* parts; but yet some of the *similar* may be also termed *organical*: as for instance, a *Nerve*, which conveys and distributes the animal spirits; and likewise the *Arteries* and *Veins*, which do the same to the blood.

and non-organical: as also into principal,

A *non-organical* part is that which has only an use, and no action: as a gristle, fat, &c.

Again in respect of their *function*, or *end*, the parts are divided into *principal*, and *ministering*.

A *principal* part is that which performs the most noble and principal action, and from which the actions of many other parts proceed, or are assisted. Of which sort are, 1. The *Heart*, which is the (distributing) fountain of vital heat, and nutritive blood, communicating both to all the other parts, by its continual pulsation. 2. The *Brain*, which is the fountain of the animal spirits, and so the Author of all sense and motion. To these some add, 3. the *Genitals*, on which the preservation of the *Species* depends; as on the other, that of the *Individual*.

A *ministring* part is that which ministers to or *and* ministring. assists the principal : such as are the Stomach, Liver, Reins, the Hand, &c. And of these some are *necessary*, others *not*.

The *necessary* are those without which a man cannot live. Such as are the Stomach, Liver, Lungs, &c. *The ministring are either necessary, or not necessary.*

The *not necessary* are such as contribute to the well-being, but are not absolutely necessary to the life of a Man : as an Hand, a Leg, simple muscular flesh, which in consumptive persons is almost wholly spent.

There are also other divisions of the parts of the Body, as into parts *containing*, parts *contained*, and the *spirits*, express'd by *ἰσχυρισμοί*, or *impetum facientes*, by *Hippocrates*.

Fernelius divides the Body also into *publick*, and *private Regions*. The *private* are such as the Brain, Reins, Womb, &c. The *publick* are Three. The first includes the *Vena portæ*, and all the parts whither its Branches reach. The second begins at the roots of the *Cava*, and ends in the small veins before they become capillary. The third contains the Muscles, Bones, and the bulk of the Body, and is terminated by the Skin. But this division is only of use in Medicin.

CH A P. II.

Of the Circumscription, Regions, and Parts of the Abdomen.

IN the former Chapter we divided the *Whole* Body into the *Venters*, and *Limbs*. Of which, because the *Venters* are more subject to Putrefaction,

faction, as containing parts that are very moist and flabby; whereas the Limbs consist of parts that are more dry and firm, such as the Bones, Muscles and Tendons: I say, on this account, the Venters are usually first dissected, and of them first of all the *Abdomen* or Lower Belly that contains the Guts, which, of all other parts, are aptest in a short time to send forth noisome smells, and to be offensive to the Anatomist. We shall begin with it therefore, and in the second place proceed to the middle Venter or *Chest*, and last of all to the *Head*: making each of these the subject of a particular *Book*.

Before we begin to cut open the *Abdomen*, three things are to be considered in relation to it. First, Its *Circumscription* or *Bounds*. Secondly, Its *Regions*. Thirdly, The special or constituent *Parts* of it.

The Circumscription of the Abdomen.

As concerning the *Circumscription* of it, its upper part is severed (within) from the Breast by the Midriff. In the *fore-side* it is bounded *above* by the *Cartilago ensiformis*, or the Heart-pit, and *beneath* by the Share-bones. On the *sides*, by the short Ribs, and *Ossa Iliæ*, or Hip-bones. *Behind*, by the *vertebræ* of the Loins, *Os Sacrum*, and the *Coccyx*.

Its Regions.
1. Anterior.

Its *Regions* are either *Anterior*, or *Posterior*. The *Anterior* (which comprehends also the *Lateral*) is subdivided into three others, viz. the uppermost, middle, and lowest.

The uppermost, which reaches from the *Cartilago ensiformis* to within three inches above the Navel, (parallel to the lowest of the short Ribs) hath three parts. Two *lateral*, which are called *hypochondria*, or *subcartilaginea*, because they lie under the Cartilages of the short Ribs. In the right *hypochondrium*

pochondrium lieth the greatest part of the Liver, and part of the Stomach; and in the left, the Spleen, and a greater part of the Stomach. The third part is that which lieth *before*, between the two lateral parts, and is properly called *Epigastrium*, because the (middle of the) Stomach lieth under it. In this part remarkable is the Pit of the Breast, which formerly has been used to be called *ragdia*, but *scrobiculus cordis* by the modern Writers.

The middle Region extendeth it self from three inches above the Navel, to three inches under it. The forepart is that where the Navel is, from whence it is called *Regio umbilicalis*. The two lateral parts are called in English the *Flanks*; in Latin *Iliia*; by Aristotle *λαγνές*, either from their laxity or softness, or from *λαγνεία*, *salacitas*, as if they were the seat of Lust; by Galen *καρεῶνες*, because being placed between the *Ossa Iliia*, and Ribs, they are lank, and seem empty. They are called by Dr. Glisson, *Epicolicæ*, because on each side, this Region investeth the lateral parts of the Gut Colon.

The lowest Region is called *ὑπογάστριον*, *hypogastrium*. This Region reacheth from three inches below the Navel, to the *Os Pubis* and Groins, and hath three parts; two lateral, and one anterior or middle. The lateral are bounded by the *Ossa Iliia*, so called, because a great part of the *Ilium intestinum* lieth under them on each side. Besides this, in the right lateral part are placed the beginning of the Colon, and all the *Cæcum intestinum*. In the left are contained the ending of the Colon, and beginning of the *intestinum Rectum*.

The forepart of the *Hypogastrium* by Aristotle, lib. 1. *Hist. animal.* 3. is called *ἄστρον*, by some (in special) *Abdomen*. At the lower part of it is seated the

the *Pubes*, which in the adult or ripe of age is covered with hair; and on each side of this, the Groins, called *Scrotæ*, or *Inguina*. Within this forepart of the lowest Region, are contained part of the Mesentery and small Guts, the Bladder, and in Women the Womb.

2. *Posterior.*

The *posterior* Region is divided into two parts, the upper and lower.

The *upper* is called the *Region of the Loins*, reaching from the root of the Midriff to the top of *Os sacrum*, and contains within it the Kidneys, the *Pancreas Asellii*, and Centre of the Mesentery, the Receptacle of the Chyle, and the descending trunks of the *Cava* and *Aorta*.

The *lower* part of the hinder Region reaches from the top of *Os sacrum*, to the lower end of the Rump-bone or *Coccyx*. It is much broader above than below, and within it are included the straight Gut, part of the Ureters, and in Women the Testicles or *Ovaria*, &c.

Its parts.

The *parts* of the *Abdomen* are *containing* (or outer) and *contained* (or inner.)

Containing,

The *containing* parts are such as are either *common* to it with the rest of the Body; or are *proper* to the *Abdomen* alone.

and contained.

The parts *contained* serve either for *concoction*, for *separation of excrements*, or for *generation*. Of all which in order, and first of the *common containing* parts.

C H A P.

C H A P. III.

Of the common containing parts of the Belly.

THE common containing parts of the Belly are five, the cuticle or scarf-skin, the skin, the fat, the *membrana carnosa*, and the common membrane of the Muscles.

The common containing parts of the Belly.

The scarf-skin, in Greek is named *ἐνδερμὶς*, *ἐν τῇ τῇ σῆμα ἰδερμὶς*, because it is placed upon the true skin as a covering. It is as large as the true skin, and more compact; for the ferous humour that in pustules and blisters ouzes through that, is stopt by the density of this. Yet it is full of pores, for the evacuation of sweat, and exhalation of vapors. It has neither blood-vessels nor nerves dispersed through it, and therefore is void of sense.

1. Cuticula, or scarf-skin.

It is bred of a viscous and oleous vapour of the blood, raised and exhaled by the natural heat of the subjacent parts, and dried and condensed by the external cold, as most Anatomists have taught; but Dr. Glisson thinks it to be a soft, slippery, viscid and transparent juice (like the white of an Egg) issuing out of the capillary extremities of the nerves, which end in the outward superficies of the true skin, where it is coagulated, and by its viscosity sticketh upon it like glue; so that it can hardly be separated therefrom by a knife, but may easily by a vesicatory. It sometimes also almost wholly peels off in Scarlet or burning Fevers, and the Small-Pox; but a new one presently succeeds it. Diemerbroeck thinks, it is bred neither of these ways, but has a seminal principle as well as the skin it self, or any other solid part. But not so probably, seeing it has no sense, and may be

Its matter.

often

often quite lost, and yet presently regenerated : all which circumstances agree to no part that has a seminal principle. And whereas he objects, that because Infants when they are born have a scarf-skin, therefore it cannot be bred by condensation, seeing there is neither cold nor driness in the womb, but on the contrary warmth and moisture, which will hinder all condensation ; Dr. *Glisson* solves this Objection, by shewing how a Liquor may be condensed or indurated two ways : the one, by separation of the thinner parts by way of exhalation, which is properly called *desiccation*, and this he confesses cannot happen in the womb ; the other, by *coagulation*, that is, by separating the more serous part of the matter from the thicker particles ; which sort of condensation may take place well enough in the womb. See his *tract. de ventric. &c.* p. 11, 12. where he very clearly makes this out.

Some, from their observations by their Microscopes, affirm the Cuticle to be scaly, like that of Fishes : But seeing it is so dense as to contain the *serum* in raising of blisters, (as well as for other reasons) 'tis very improbable that 'tis of that texture, though perhaps its outer surface may appear so.

Uses.

The use of it is, First, To defend the Skin, (which is of an exquisite sense) from external immoderate either heat or cold. In cold weather its pores are so straitned, that the more tender parts lying under it are not too much affected with the cold : In hot weather by its compactness it hindreth too great perspiration.

Secondly, To be a *medium* between the Skin and the object to be felt ; for when it is rubb'd off, the true Skin cannot endure the touch of other Bodies without pain.

Thirdly,

Thirdly, To hinder the ferous humour from issuing from the Arteries; for this we see to happen when the *cuticula* is rubbed off by any means.

Fourthly, To make the Body more beautiful; which it does by smoothing the asperities of the true Skin, and inducing a comely colour of white and red. Whiteness is natural to this part, and the redness is owing to the blood that is affus'd to the outward superficies of the true Skin: which being seen through the Scarf-skin makes that florid colour.

Next under the Cuticle lieth the *true Skin*, ^{2. Cutis; or the true skin.} which is five or six times thicker than it. In Greek 'tis called *Sequa* or *Stess*, either from *Sepe* to *fley*, or *q. sequa*, because it is the end or superficial boundary of the body.

It is naturally *white*, as other membranes: but ^{Its Colour.} in living and healthful persons, and such as live in a temperate or somewhat cold climate, from the afflux of the blood toward it, and the colour of the subjacent parts, it is of a reddish rosie colour. But in those that live under the *Æquinoctial Line* and in excessively hot Climates it appears black: Not but that both it self and also the Cuticle are truly white in them, as they are in the Europeans; but, as *Malpighius* probably conjectures, it appears of that hue from the blackness of that mucous and reticular body which lies betwixt it and the Cuticle, of which more by and by.

It is made up of *nervous fibres* very closely interwoven one with another, and of a *parenchyma* ^{Matter;} that fills up the interstices and inequalities thereof. That it has such a *parenchyma* may appear by this, that when a Sheep-skin (for instance) has been some while steeped in water, one may
C with

with an ivory knife or the like scrape a great deal of mucous slimy matter off it, whereby it becomes much lighter, thinner and in some measure transparent, as we see in Parchment. Moreover, according to *Malpighius*, it is beset with innumerable pyramidal *papillæ*, whose heads jet out of its surface, but are covered by the Cuticle: which *papillæ* he is inclined to believe to be the ends of the Nerves perforating the skin, and not raised from the skins proper substance. And amongst them, he says, there is spread over the surface of the skin, a certain mucous and *reticular* body with holes in it for the emersion of their heads, and also for the passage of the Sweat-vessels. These Sweat-vessels arise from the glands that the skin is every where beset with, and convey out that sweat that is separated from the Arteries in the glands.

This *reticular* body of *Malpighius*, *Frederick Ruysch* (in his answer to *Gaubius's* first Letter, p. 10.) says, "cannot be seen without optick instruments, and can hardly be shew'd by the vulgar and common way of dissection, much less can the pyramidal *papillæ*; particles, which the Professors of Anatomy in their dissections are wont to take no notice of, although they are to be reckon'd so necessary to be known and seen of the Students of Physick, that they are by no means to be neglected in anatomical administrations, especially private ones. Of the *reticular* body and of the pyramidal *papillæ* you have his Figures in the first Table of this Book.

*Difference
of thick-
ness.*

The Skin in the Forehead and Sides is thin, thinner yet in the palm of the Hand, but thinnest of all in the Lips: In the Head, Back, and under the Heel it is thickest. It is thinner in Children and Women than in Men; and in those that live
in

in hot Countries, than those that live in cold. And this (as *Spigelius* observes) is the reason why those that are born in cold Countries, when they come under the *Æquinoctial Line*, are often taken with Fevers, because that great heat that is there excited in the Body by the outward air; cannot exhale through the too thick Skin; but being retained induces a preternatural heat, and so a Fever.

It is full of *Pores*, as well as the *cuticula*. For *Pores*: those who deny them, oppose not only reason, but ocular demonstration. The passing of Quick-silver through a Sheep-skin evidences this; and Mr. *Boyle* has tryed the same in a piece of the skin of a Man's arm. And any one may satisfy himself by an ordinary Perspective, or but a good pair of Spectacles, of the same. For if when he is sweaty, he wipe off the sweat from the tips of his fingers, he may plainly see fresh sweat issue out by the pores, and stand in little drops.

It is of a most exact *temperature*, neither too cold nor too hot, that it might the more accurately judge of the temperature of tangible things. *Temperature, and vessels:* Its *nervous* part, which is naturally cold, is attemper'd by the heat of the arterial blood that flows continually for the supply of its parenchymatous part: and its *parenchyma* is not heated too much by the afflux of the blood, because it is lodged amongst so numerous cold nervous fibres. It has very many both capillary *Arteries* and *Veins* distributed through it; as also abundance of *nervous* twigs, which endue it with a most exquisite sense.

As for the *hair* that in many places grows out of the skin, we shall defer our discourse of it, till we come to treat of the hair of the Head, in Book III. chap. 2. *Hairs*

Action.

Its *action* is sensation or feeling. Which action is chiefly performed by those fore-mentioned pyramidal *papillæ* which *Malpighius* by the Microscope has observed to arise out of it, in greater plenty in such parts as are of more exquisite sense, as the palm of the hand, sole of the foot, &c. but in less, in such as are of a more dull.

Uses.

Its *use* is, First, to cloath the whole Body, and defend it from the injuries of the weather, &c. Secondly, To be a general vent or emunctory to the Body, by which all its exhalations may fitly transpire. Which whether it be done only through its pores, as most Anatomists have affirmed; or also through its very substance, as *Dr. Glisson* has of late asserted, is a controversie hardly worth the insisting on.

Lastly, In several places of the body to put forth and nourish the hair, for the fence and ornament of the respective parts.

3. *Fat.*

Next under the Skin lies the *Fat*, which is commonly taken to be a covering distinct from the *membrana carnosa* that lies under it, having the name of *membrana adiposa* given it; but *Dr. Glisson* reputes it only a part of the *carnosa*: for he says, that membrane in its outer part is full of membranous cells, which are fill'd with a yellowish fat, somewhat like as the cells in the pulp of an Orange are filled with its juice. *Malpighius* says, "The Blood-vessels are expanded like the boughs of trees, every where through the membrane that lies under the Fat, and the membranous cells full of fatty globules hang upon their ends, like leaves upon the boughs of trees. The cells are of almost an oval figure, and are like the lobules of which the Lungs are composed, or rather like a conglomerate gland. "They

“ They are knit to one another by the membrane out of which they are formed. And through the same membrane and cells, he says, do not only capillary Veins and Arteries, but *ductus adiposi* also run, which swell with fat, especially if they be beheld in an Animal newly kill’d. Whether these vessels, *adds he*, propagated through all the fat that is placed in the circumference (or *ambitus*) of the body, flow from the Caul, as from their root, sends has not as yet discover’d: But seeing the Caul is knit to the back, as to the centre of the whole body, it does not seem unlikely but that they may be propagated into every region of the body, by means of the *membrana adiposa* that is extended over all: as we observe of the Lympheducts, though they want any notable and common trunk.” Thus far he.] Whether we should call it *Fat*, or the *fatty membrane*, is not worth the while to dispute: nor much matters it, whether we repute the Fat, and subjacent membrane, for one or two integuments. Let every one enjoy his opinion. For my self, I chuse rather to distinguish them, and consider them apart.

Fat is defined to be a greasie substance, bred of its definition. the oily portion of the aliment and blood, condensed by cold.

In Men it is placed next under the skin, and *Situation.* that all the Body over, except in the Lips, the upper part of the Ear, Eye-lids, Cod and Yard, which have no fat at all; and in the Forehead, where the skin cleaveth close to the carnos membrane, as also according to some, in the Temples. It is collected in the cells before-mentioned, and according to the common opinion is bred of an oily portion of the blood sweat-

ing like a dew out of the Veins, and afterwards concreting: but according to *Malpighius*, the *vasa adiposa* are the conduits of its matter, as shall be further shewn in Chap. 5. of the *Omentum* or *Caul*.

This Fat is properly called *Pinguedo*, whereas that of the *Caul*, &c. is called *sebum*, Suet or Tallow. And they differ in this, that *pinguedo* is easily melted, but not so easily congealed; whereas *sebum* is not easily melted, but is easily congealed. Besides, *pinguedo* is not brittle, but *sebum* is.

The uses of it are these; First, It defendeth the Body from the external air.

Secondly, It preserveth the natural heat.

Thirdly, It furthereth beauty by filling up the interstices of the Muscles and wrinkles of the Skin; whence very lean people for want of it look shrivel'd and deformed.

Fourthly, By filling up the empty spaces between the Muscles, it rendreth the motion thereof more glib and easie, (so it do not abound too much) and keepeth all the parts from driness, or breaking. Hence it besmeares the extremities of the Cartilages, the jointings of the greater Bones, and the Vessels that they may pass safely.

Lastly, *Malpighius*, rejecting all these uses as primarily intended, thinks the principal use of it, whilst it is mixed with the blood, is to be a continual *pabulum* (or food) of the natural heat, whereby the vital flame (and consequently heat) is perpetuated. Also to mitigate the acrimony of the blood, and join and unite the saline particles thereof so as that they become assimilable to the solid parts for their nutriment, serving to those particles as oil to colours in painting, or lime to stones in building. When it is separated from

from the blood, and collected here or other where, he is inclin'd to the common opinion, that in case of famine it passes into the nourishment of the body. But as to its more ordinary use when collected in particular parts, the Reader may find it where those parts are treated of.

The *Carnous membrane* is only properly so called in Brutes, in whom it is truly *fleshy* and muscular, so that by means hereof they can at pleasure move and shake their skin which is contiguous to it, no fat intervening between them: But in Man, seeing it has no carnous fibres, or *parenchyma*, it is very improperly termed *carnous*. We shewed just now Dr. *Glisson's* opinion to be, that it is not truly distinct from the *Fat*, but the *Fat* is a part of it: and upon account of the fat that adheres to it, he thinks it deserves the name of *adiposa* rather than *carnosa*. Only in the Forehead and Neck it looks somewhat fleshy, and therefore may in those places with better reason be called so.

The *uses* that we ascribed to the *fat* agree also to this membrane, *viz.* to defend the body from external cold, and to preserve the natural heat, &c. yea it serves also to sustain and strengthen the vessels that pass betwixt the skin and muscles between which it is placed. Some make this membrane the seat of that *borrou* or shivering that happens in the beginning of *Ague-fits*, supposing it to be of exquisite sense, and that it is then twitched by sharp humours. But I think that symptom rather proceeds from the like affection of the membrane next under it, which is

The *common membrane of the Muscles*. This is spread over all the body (except the skull, according

4. Mem-
brane
carnosa.

Its Use.

5. The com-
mon mem-
brane of the
Muscles.

ding to some) and is knit by fibres somewhat loosely both to the foregoing that lies above it, and to the proper membrane of each Muscle that lie under it. It is very thin, but strong: It is not yellow like the former, but whiter and more transparent.

Its Glands. Dr. *Havers* in his *Osteologia nova*, p. 199. says, "he has observed the same sort of glandules in this membrane, as those which occupy the membrane that lies over the Joints in all that part which has none of the large Glands: and amongst many of the Tendons there are several of the larger Glands, or the lesser glandules conglomerated into the form of Glands. So that he dare be positive in this assertion, that the common membrane of the Muscles is every where glandulous.

Use. Upon this supposition, the use of this membrane must be *not only* (as has hitherto been taught) to serve as a common bag to contain the Muscles in, and to help to keep them in their proper places: *but also* to moisten and besmear the subjacent Muscles and their Tendons with a mucilaginous liquor, which lubricates them, and so makes them more glib and pliable in their motion.

CHAP. IV.

Of the proper containing parts.

The proper containing parts of the Belly. **T**HE proper containing parts are the Muscles of the Belly, and the *Peritoneum*.

As to the *Muscles*, seeing we have assigned a particular Book (*viz.* the fifth) for the description of all the Muscles of the Body, we shall refer the Reader thither for these of the *Abdomen*, where he may find them fully described *Chap.* 17. and

and at present content our selves with only naming of them. There are *five* pair of them : The outermost are the *Obliquely descending* ; the next, the *Obliquely ascending* ; the third, the *Recti* ; the fourth, the *Pyramidal* ; and the inmost, the *Transverse*. All which being removed, the *Peritonæum* appears next.

The *Peritonæum* or inmost investing coat of the Belly commonly called its *Rim*, (derived from *celsum*, from its office of *encompassing*) adheres *above* to the Midriff, *below* to the Share-, and Flank- or Hip-bones ; in the *fore-part* firmly to the transverse Muscles, but chiefly to their Tendons about the *Linea alba* ; *behind* to the fleshy heads of these Muscles loosely. The end of this connexion is both for its own strength, and that it may the better comply with and serve the Muscles in their compression of the Belly.

Its figure is oval ; and its substance membranous. The inner superficies of it, which respects the Guts, is smooth, equal, and slippery, bedewed with a kind of watery humour steaming or exhaling from the parts contained in the *Abdomen* : but the outer superficies, whereby it cleaves to the aforesaid Bones and Muscles, is rough and unequal.

As for the *origine* of it, *Fallopious* will have it to proceed from the superiour and inferiour plexus of Nerves of the *Abdomen* ; for from them it cannot be separated without tearing. To him *Dr. Glisson* assents. Some derive it from the Ligaments by which the *vertebra* of the Loins, and of *Os sacrum* are knit one to another, especially from those of the first and third of the Loins, because it is there thickest. *Diemerbroeck* denies it to have any origine at all, other than the first seminal matter out of which it was formed in the womb,

womb. But that is only its *material* principle, and hinders not but that it may have (according to Dr. *Glisson's* distinction) a principle or origine of continuation.

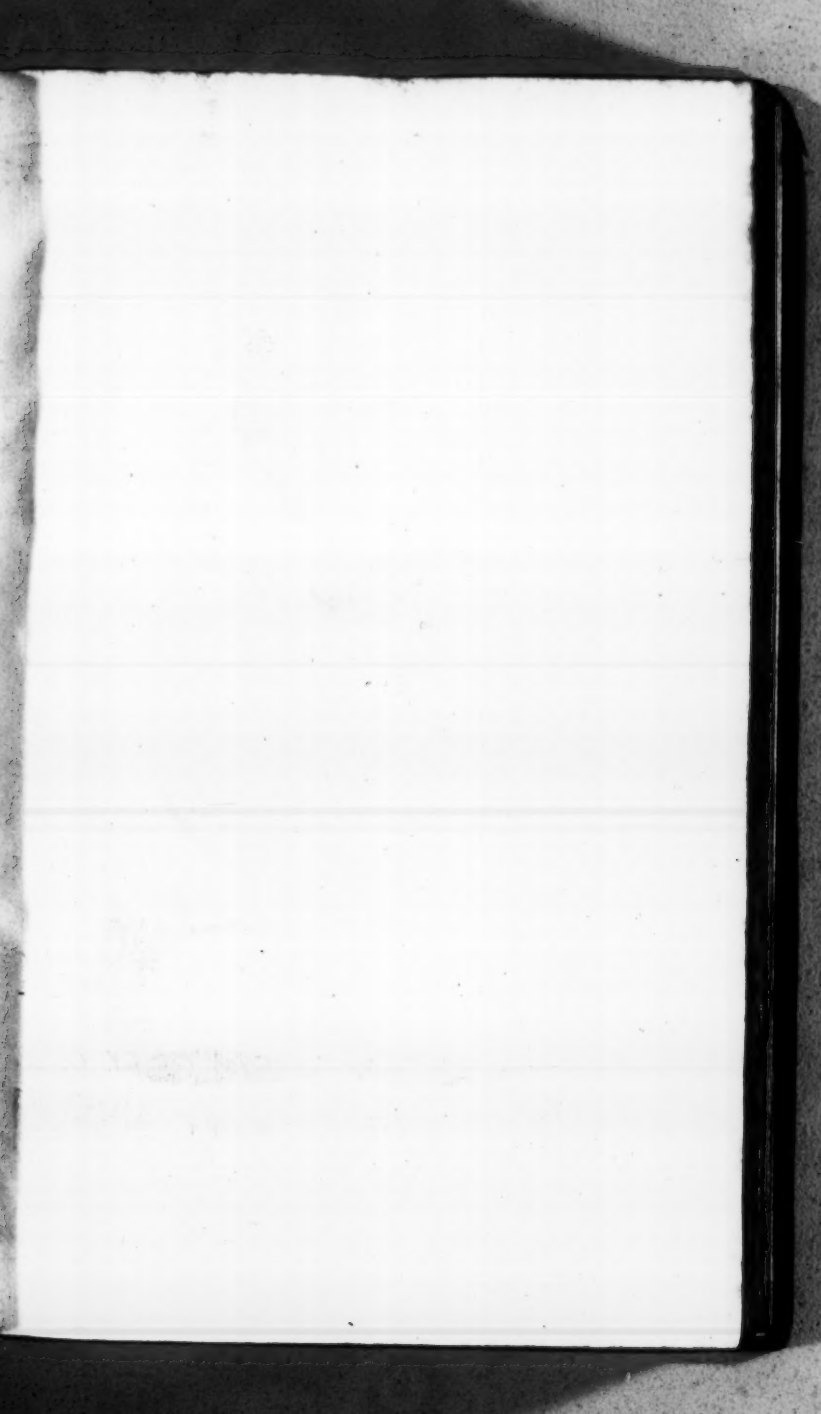
Duplicity. It is double every where, but appears so to be chiefly about the *vertebræ* of the Loins, and in the *Hypogastrium*. For in the former place between its membranes lie the *Vena cava*, the *Aorta*, the Receptacle of the Chyle, and the Kidneys; and in the latter, the Bladder, and in Women the Womb.

Perforations.

Above, where it adheres to the Midriff, it has three *foramina* or holes; the first on the right side, whereby the ascending trunk of the *Vena cava* passes; the second towards the left side, for the Gullet (with the Nerves of the eighth pair inserted into the upper Orifice of the Stomach to descend by; the third behind, by which the great Artery or *Aorta*, and the intercostal Nerve descend, and the *ductus chyloferus* ascends. *Below*, it has passages for the straight Gut, for the neck of the Bladder, and in Women for the *vagina* of the Womb; also for the Veins, Arteries and Nerves that pass down to the Thighs. *Before*, in a *fœtus*, for the umbilical Vessels, to pass in and out by.

Processes.

It has two remarkable *Processes* in Men placed before, by the *os pubis*, on each side one. They are certain oblong productions of its outer Membrane passing through the holes of the Tendons of the oblique and transverse Muscles, and depending into the Cod, there bestowing one Tennis on the Stones, and containing them like a bag. There are also two Processes in Women, but they reach only to the *Inguina* or Groins, and terminate in the upper part of the Privy, or the fat of *Mons Veneris*. The inner Membrane



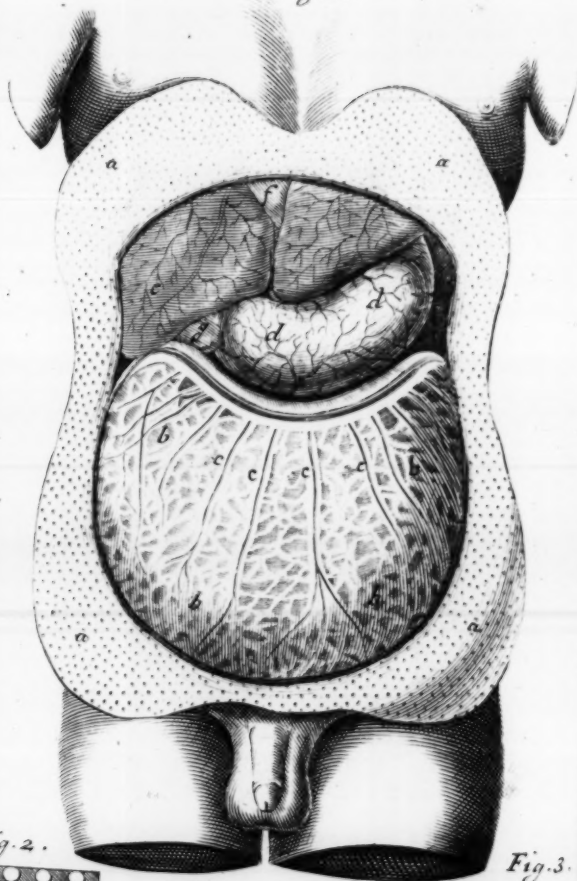


Fig. 2.

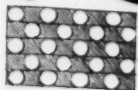


Fig. 5.



Fig. 4.



Fig. 3.



brane of the *peritoneum* (in Men) reaches but to the very holes, through which the Processes descend, which it makes very strait; but being either relaxed or broken, the outer gives way, and so there follows a Rupture, either the Caul, or the Guts, or both falling down thereby into the Cod. By the holes of the Processes there descend in Men the Vessels preparing the seed, and the Muscles called *Cremasteres*; and by them ascend the Vessels bringing back the seed. In Women there pass by them the round ligaments of the Womb, which after spreading themselves and growing jagged, are either joined to the *Clitoris*, or else terminate before they come at it, in the fat of *Mons Veneris*.

It has *Arteries* and *Veins* from the Mammary Vessels, and Epigastrick, and from those of the Midriff, or the Phrenick. It has slender threads of *Nerves* from the pairs of the *Vertebra* of the Loins chiefly.

Its use is to assist the equal and orderly contraction of the belly for the expulsion of the excrements, and by its smoothness to prevent the Guts being hurt by the circumjacent parts. Its several other more private uses may be observed in the foregoing description of it.

And thus far of the parts *Containing*.

T A B. I.

Fig. 1. shews the parts contained in the *Abdomen*, which appear to the first view after all the containing parts are removed.

aaaa The Skin of the Abdomen turned back, whose inside is fatty.

bbbb The Omentum or Caul,

cccc The

cccc The Gastro-epiploick vessels.

dd The Stomach.

ee The Liver turned somewhat up, that the Stomach may be the better seen.

f The broad suspensory ligament whereby the Liver is fastened above to the Midriff.

g The Gall-bladder which is seated in the under or hollow side of the Liver, but here appears through the Liver's being lifted up.

Fig. 2. shews (from Ruysch) the true delineation of Malpighius's reticular and subcuticular body, as it appears by a microscope.

Fig. 3. shews the pyramidal papillæ in like manner.

Fig. 4. shews the reticular body about as large again as its natural bigness.

Fig. 5. shews the pyramidal papillæ likewise twice as big.

CHAP. V.

Of the Omentum.

Of the parts contained in the lower Belly.

THE parts Contained minister either to Nutrition, for the conservation of the Individual; or to Procreation, for the conservation of the Species.

Nutrition being an assimilating the Food taken, into the substance of the parts; before this is done, it undergoes two changes, first into chyle, and then into blood.

All the Organs of Chylification are included within the Abdomen; but of Sanguification not so.

The principal Instrument of Chylification is the Stomach;

Stomach; but the *Caul*, *Guts*, (especially the small) *Pancreas*, &c. are assisting to the Action.

The principal Instruments of *Sanguification* were heretofore supposed to be the *Liver* and *Spleen*, upon a presumption that all the *Chyle* went to the one or other directly from the *Guts*: But since it has been discover'd that none of the *vena lactea* pass to them, but that the whole *Chyle* is conveyed into the common Receptacle, and from thence directly by the *ductus thoracicus* to the *Heart*, they are discharged from the task of *sanguification*; though it cannot be denied, but they contribute to the refining and perfecting of the *Bloud* already made.

Both the *Chyle* and *Bloud* have their *Excrements*, the chief whereof are both separated from them, and conducted out of the *Body* by parts contained in the *Abdomen*. Those of the *Chyle* are the *feces*, collected in the thicker *Guts*, and evacuated by stool. Those of the *Bloud* have been taught to be two, viz. *choler* and the *serous humour*. *Choler* is separated by the *Liver*, and is received the thinner part of it by the *vesica fellea*; but the thicker by the *porus bilarius*. But it is not purely an excrement, seeing it has a considerable use within the body, as will appear in chap. 11. of the *Liver*, and deserves not that name any more than the juice separated by the *Pancreas*. The *serous humour* is separated by the *Kidneys*, and from thence conveyed to the *Bladder* by the *Ureters*, to be piss'd out.

The parts ministering to *Procreation*, are the *Genitals* both in *Men* and *Women*.

After the *Peritonæum* is ript open, the part which lies uppermost is the *Caul*. In Greek it is called ἐπιπλόον from ἐπιπλέω *innas*ο, because it seemeth

The Caul.
Its names.

seemeth to swim upon the Guts. In Latin, *Omentum*, from *Omen*, because the Soothsayers used to divine by it; and otherwise *Rete*, or *Reticulum*, from its contexture, which is *Net-like*; whence also in English it is commonly called the *Net*.

Substance. It is composed of two *Membranes*, betwixt which the Vessels run, and the Fat and Glands are placed. They are very thin, and, where the Fat hinders not, transparent.

Figure. For *shape*, it is compared by Dr. *Gliffon* to a Woman's Apron, when the lower part of it is turn'd up and tuck'd under the girdle. For it consists of two Leaves, whose upper edges are knit to different parts; but its bottom is continued, and is like the bottom of a Satchel, to which it is also compared by some.

Connexion. I say its two upper edges are knit to different parts: for that of the *fore* Leaf, beginning at the little Lobe of the Liver (which it involves) adheres to the under or hollow side of the Liver, to the *duodenum* and *pylorus* (somewhat towards their fore-side) to the bottom of the Stomach, and to the suture of the Spleen. That of the *bind* or *inner* Leaf is continued from the former, and passing from the Spleen backwards, returns towards the right side again, by the way adhering to the *Pancreas*, to that part of the *Colon* that runs under the Stomach, to the Back, to the *duodenum* (somewhat towards its back-side) and at last is joined or continued to the fore Leaf at the aforesaid little Lobe of the Liver. As for its bottom, it is knit to no part, but hangs loose upon the Guts, reaching commonly a little below the Navel, but sometimes to the very bottom of the Belly. Sometimes it falls down out of its place, and descends into the Cod, which kind of Rupture is called *Epiplocele*; and other times when

the Navel has been burst, it has jetted out and filled the same, as in the *Omphalocele*.

It is commonly said to have a double *origine*, *Rise*, namely, its fore leaf to spring from the Stomach, and its hinder from the *Colon*. But seeing both these have their outer Coats from the *Peritoneum*, and that the Caul it self cleaves also to it at the back, it is most reasonable to draw its rise from thence. Whence descending to below the Navel, it turns up again, and ascending to the Stomach, cleaves to it; and so may more properly be said to end, than to begin there.

Between its Leaves or Walls there is formed a *Cavity*, notable *cavity*, which some very weakly have destined to divers uses; whereas it results onely accidentally, and was not framed by Nature for its own sake. "For (as Dr. *Glisson* reasoneth) whilst Nature is sollicitous about providing a fit deputy (and that membranous) for the Mesentery, and stuffing it with fat, through which Vessels may be carried to the Stomach, Liver, Spleen, *Pancreas* and *Colon*, and whereby she may join all those parts after a due manner; and moreover whilst she takes care that it hang down loosely, and besmear both the Stomach and Intestines with its unctuousness; and in the mean while be every where continuous to it self: I say, whilst she diligently proposes all these ends, if she will obtain them, she must needs make the Caul hollow as it is above described, and its propending part must needs imitate the bottom of a pouch.]

The *Omentum* aboundeth with *Vessels* of several sorts, but such as do not properly belong to it, or terminate in it, but are carried through it to other parts, from which they are most of them denominated. We shall begin with the *Arteries*, *Arteries*, and

and translate hither the account that the above-named Doctour gives of them, and also of the Veins, which is very exact. " Its *Arteries* are
" propagated from the *Cœliaca*; or rather, its
" inner Leaf, near its origine, receives and up-
" holds this Artery, (as soon as it springs out of
" the *Aorta*) betwixt its Membranes. It is divi-
" ded into two branches, the *right* and *left*. The
" *right* being joined to the *vena Porta* in the *Pan-*
" *creas*, and fenced with the Membranes of the
" *Omentum*, is carried into the hollow side of the
" Liver: but it first sends forth these branches;
" the *pyloricus*, to the hinder side of the right ori-
" fice of the Stomach; the *arteria cystica gemella*,
" the *epiplois dextra*, a portion whereof is dispen-
" sed to the Gut Colon; the *intestinalis*, carried
" to the *duodenum* and beginning of the *jejunum*;
" the *gastro-epiplois dextra*, which is distributed
" into the bottom of the right side of the Sto-
" mach—The *left branch* of the *cœliaca*, called
" *splenicus*, is greater than the *right*, and being
" included within the Membranes of the hinder
" Leaf of the *omentum*, is carried directly left-
" ways under the bottom of the Stomach to the
" future of the Spleen. In its passage it sends
" forth many branches: *Upwards*, one notable
" one called *arteria gastrica*, which spreads it self
" through the bottom and sides of the Stomach,
" and its upper orifice, where it gets the name
" of *coronaria*; also a *second* called *gastro-epiplois si-*
" *nistra*, whereof one portion is dispersed into
" the bottom of the left part of the Stomach, and
" both its fore and hinder parts, and the remain-
" der is spent on the fore Leaf of the *omentum*;
" it sends forth a *third* also, that famous branch
" called *vas breve arteriosum*, which is inserted
" into the left side of the left or upper orifice of

“ the Stomach. *Downwards* also it shoots forth
 “ some branches, as the *epiplois sinistra*, which be-
 “ ing divided into two rivulets waters partly the
 “ hinder Leaf of the *omentum*, and partly the
 “ colon it self; also another little branch which is
 “ wholly spent on the left part of the hinder
 “ Leaf of the Caul.

“ The *Veins* that answer to the said Arteries ^{2. Veins:}
 “ rise almost all from the *splenick* branch; the
 “ trunk of which Veins, after it is joined with
 “ the stem of the *splenick* Artery, puts forth
 “ branches exactly answering and proportioned
 “ to those of the said Artery; and all the bran-
 “ ches of both Vessels are dispensed to the same
 “ respective parts, and are denominated from
 “ them, so that ’twould be needless to stay longer
 “ on their distribution: onely the branch that
 “ goes to the right or lower orifice of the Ven-
 “ tricle, called of some *pyloricus*, takes its rise
 “ from the trunk of the *porta* before ’tis di-
 “ vided.

It has but very small *Nerves* proceeding from ^{3. Nerves:}
 the intercostal or ninth pair: which, as the Veins,
 accompanying the Arteries and having the same
 names, we shall not take the pains to trace.

But besides these Vessels formerly known, *Mal-* ^{4. Vasa}
pighius thinks that he has discovered a new sort, *Adiposa:*
 which he calls *ductus adiposi*, and will have to
 nourish and encrease the Fat, discharging the Ar-
 teries and Veins from that office. He says,
 “ they are so very small that they admit not a
 “ ligature, from whence one might discover their
 “ nature; *viz.* whether they be hollow, so as
 “ that the Fat might be propagated by them as by
 “ pipes; or whether they be only like filaments
 “ or small threads, along which the fatty parti-
 “ cles drill. But he inclines to think, they are
 D “ hollow

“hollow like Veins. He confesses, that he could
“not yet discover by the Eye from whence they
“take their rise, though he has endeavoured to
“find it out in many, and those divers, sorts of
“Animals; but thinks it probable, that they ei-
“ther spring from the Spleen, or from the Sto-
“mach, or from the Glands. The reasons why
he suspects they may spring from the Spleen are,
“That there is a notable Vein arising from the
“Spleen, that sends abundance of slips all through
“the Caul, and the Spleen in all Creatures is
“placed in the Center of the Caul: And that
“there are abundance of fibrous Bodies discern-
“able in the Spleen, that run through its Paren-
“chyma from one Membrane to another, and
“have no communication with the Blood-vessels.
“These, he says, so far as he could perceive, are
“closely knit to the Membrane of the Caul that
“enters the Line or Suture of the Spleen with
“the Splenick vessel; and seeing it appears not
“as yet, whether they be hollow, or of what
“origine they are, or what use they serve for,
“one may reasonably doubt whether they be not
“the first root of these *ductus adiposi*, or at least
“have communication with them. As for their
“rise from the Stomach, this may be said, That
“the Caul has a notable connexion with it, be-
“ing knit strongly to it through its whole
“length, and receiving Blood-vessels from it.
“That in some Fish there grows a notable Mem-
“brane from the bottom of the Stomach, that
“has Vessels differing from the sanguineous.
“And he thinks it not unreasonable to suppose,
“seeing in the Stomach, and in the Intestines
“that are continued to it, by means of the at-
“trition and exquisite solution of the Food, the
“particles of it acquire such a liberty, that those
“that

" that were originally in it being let loose, or
 " by a new mixture and mutual adaptation being
 " shaped and conglobated into a new nature,
 " have new motions and actions; I say, seeing
 " by these means there may not want matter for
 " propagating of Fat, it will not be improbable
 " that there are proper Vessels also for the pro-
 " pagating of it, and conveying it to the parts.
 " The third part whence these Ducts may arise,
 " are the *Glands*, into which, later Anatomists
 " have observed lacteal Vessels to be carried.
 " The Glands themselves (he says) contain
 " much Fat, from whence it is that they are so
 " luscious to the taste; and he thinks it prob-
 " able, that the Glands are either the Fountains
 " of Fat, or at least are a *medium* of its propa-
 " gation.] Thus that curious Person. But whe-
 " ther there be indeed such peculiar Vessels, I can-
 " not affirm, having never been able to discover
 " them by the naked Eye, or by such Glasses as I
 " have made use of.

Dr. *Wharton* in his *Adenographia*, cap. 12. de-
 clares, That he has observed some *venæ lacteæ* Venæ lacteæ.
 arising out of the bottom of the Stomach, (*Dier-
 merbroeck* says, from the beginning of the *jejunum*)
 which are received into the *omentum*, and being
 inserted into a pretty large Gland, do from thence
 spring again, and are carried obliquely down-
 wards, crossing the right end of the *pancreas*:
 One would think, saith he, at the first sight, that
 they enter'd into the *pancreas*: but they do in
 truth pass by it, and make towards the common
 receptacle of the Chyle, into which they empty
 themselves.

The same learned Physician does in the same
 place give an account of two *Glands* that are nat-
 urally found in it. One *greater* near its being
 joyned

joined unto the *pylorus*, and into this it is that the *lacteæ* are inserted; another somewhat less placed towards the Spleen; and this he has observed sometimes double, triple, yea manifold. Preternaturally it has sometimes many more.

Fat.

The last part of which the Caul consists, is its *Fat*, which is not spread equally all over it, but is gathered there chiefly where the Vessels run; the spaces betwixt being only membranous. It is collected in little membranous Cells, included betwixt the two investing Membranes, and its matter is derived from the Blood-vessels according to the common opinion, but according to *Malpighius*, it is communicated by the *ductus adiposi* before described. The fore leaf has more fat than the hinder; and the upper part of the fore leaf that is knit to the Stomach, is the fattest of it. In very fat persons this part grows to a great bulk; but in consumptive people there is little left besides the Membranes and Vessels; and * *Peyerus* writes that in all hydropick persons that he ever dissected, (and he has dissected very many) the Caul was always extenuated and putrid.

* *Metb.*
Hist. A-
nat. Med.
p. 97.
its uses.

The *Uses* of it are these: *First*, it cherisheth the internal heat of the lower part of the Stomach, and of the Intestines. Which appears by the Story that *Galen* tells of a Fencer, who being wounded in the Belly, and the Caul being taken out, afterwards when the Wound was healed up, felt great coldness upon his Belly, so that he was forced to wear Woollen upon it. Yet *Riolanus* affirms from his own observation, that such as have had the Caul cut out, have found no prejudice by it to their concoction.

Secondly, It ministreth nourishment to the parts in

in a long want of food, its fat being received into the Veins, and mixed with the mass of blood.

Thirdly, Like the Mesentery, it serves to convey safely the Vessels to other parts, as to the Stomach, Colon, Duodenum, Spleen, &c.

Fourthly, It keeps the outer Superficies of the Guts moist and glib, that they may the better perform their Peristaltick motion.

Fifthly, It serves also to knit loosely together the Stomach, Liver, Spleen, Pancreas, Colon, and Duodenum. This connexion was to be loose, because the Stomach and Guts are sometimes distended, and sometimes empty, and accordingly take up more or less room; but yet it is not so loose, but that it is some stay to them, and partly hinders them from departing out of their places.

CHAP. VI.

Of the Gullet.

THE Caul being removed, the Stomach of the Gullet. offers it self next to examination: but seeing the Gullet is as it were the Pipe or Funnel to it, though that be seated in the Thorax, and so should be considered in the next Book; yet because of its relation to the Stomach, being but an appendage of it, we shall treat of it here, before we proceed to that.

It is called in Greek, *σώμαχος*, quasi *σώμας* & *μαχος*, its Name, because it is narrow and long: As also *οισόφαγος*, *οἰσὶν τὸ πάγναι*, because it conveys the meat to the Stomach.

It is an organical part, round and hollow, beginning at the root of the Tongue behind the

larynx, (which part of it is called *pharynx*) and descendeth from thence directly between the Windpipe and the *vertebræ* of the Neck, and the four first *vertebra* of the *Thorax*, upon which it resteth; but when it is come to the fifth *vertebra*, it giveth way to the descending trunk of the great Artery by bending a little to the right side; afterward accompanying the Artery down to the ninth *vertebra*, there it turns a little to the left again, and climbs upon the Artery; and by and by about the eleventh *vertebra* it passeth through the Midriff, a little on the left side of its nervous Centre, at a hole distinct from that of the great Artery, and is inserted or continued unto the left Orifice of the *Ventricle*.

Substance. It is framed of three *Membranes*: The *outmost* is common to it and the Stomach, and is very thin, being endowed only with membranous Fibres, and those very slender. Some derive its Origine from the Midriff, others from the *Pleura*, others from the *Peritonæum*, and others lastly, from the Ligaments of the *vertebræ* of the Neck and Breast upon which it resteth. "All which
"Opinions (according to Dr. *Glisson*) may be
"true, if they be intended only of an origine
"of continuation or connexion, seeing it is continued plainly to the three first, and knit to the
"last: but none of them is true, if they be intended of a sustaining, or maintaining origine,
"or of a principle of influence. The second or
middle is fleshy and thick, and consists of two ranks of fleshy Fibres, which ascend and descend obliquely, (spiral-wise) and do mutually intercross or cross one another, so as that the Fibre which before it meet with another to intersect, did lie underneath another, rides upon that which it intersects, and so continues uppermost

most till it come to a second, under which it passes again, and so on by turns. The third or *innermost* is indued with slender straight Fibres, and those only, as ancient Anatomists have taught; but Dr. *Willis* affirms it to have Fibres of divers kinds, and those diversily woven one with another. It is wholly nervous; saving a certain woolly or downy substance that cloaths its inside. It is continued to that Membrane that covereth the Mouth, Jaws and Lips; and (according to Dr. *Willis*) it descends three fingers breadth below the Mouth of the Stomach. From its being thus common to the Mouth, Gullet and upper orifice of the Stomach, proceeds that great consent among these parts in Vomiting, &c.

It hath *Veins* in the Neck from the Jugulars, *Vessels.* in the *Thorax* from the *vena sine pari*; but where it is joyned to the Ventricle, it hath some twigs from the *ramus coronarius*, which is a branch of the *vena porta*.

It hath *Arteries* in the Neck from the *Carotides*; in the *Thorax* from the intercostals, and in the *Abdomen* from the *ramus celiacus coronarius*.

Nerves it hath from the *par vagum* or eighth pair.

It hath four *Glandules*; two in the Throat, *Glandules.* which are called *Tonsillæ*, or Almonds, common to it and the *Larynx*, which separate a mucous or pituitous humour to moisten them. (Their description see in *Book II. chap. 14.*) Other two it hath near its middle, on its out- and back-side, about the fifth *vertebra* of the *Thorax*; namely, where it gives way to the trunk of the *Aorta*, and turns somewhat to the right-side, or at that place where the *aspera arteria* is divided into two branches. These are as big, each of them, as a Kidney-bean, and of the same shape; but some-

times there are more than two, and then they are less. They are soft and fungous: and their use has been reckoned to be for the separation of a juice to moisten the Gullet. But Dr. *Wharton* rejects this opinion, because there appears no excretory Vessel that might convey the liquor that is separated in them, to within the Gullet. However though such Vessel do not appear, yet it is more probable that they serve for that use, than for that which he assigns to them, *viz.* to draw out from the *lymphæ* that runs through them, that juice which is more mild and fit for nourishment, for the use of the Nerves that are fastened to them; or to deposite the remainder into the common chyliferous duct by a Pipe which he supposeth there must be, but does not describe.

Yes.

The Gullet serveth as a Conduit to convey Meat and Drink by from the Mouth to the Stomach: for these being turned down into the Throat by the Tongue, all the Membranes of the *pharynx* are relaxed for the reception thereof, and presently the same are squeezed down the Gullet by the constriction of its middle coat, and the Muscles of the *pharynx*. But concerning its action, and in what manner, and by what help swallowing is performed, see more fully and particularly in the fifth Book, *Of the Muscles*, chap. 12.

CH A P. VII.

Of the Ventriculus or Stomach.

The Stomach.

Its Names.

THat part which we term *the Stomach* in English, in Latin is called *Ventriculus*, without any addition, to distinguish it from the other Ventricles,

Ventricles, which have always some other word added to determine the signification, as *Ventriculus cordis*, *ventriculus cerebri*. In Greek it is called καρδις, and κοιλία, (from its cavity) as also καρδία, which last name is given chiefly to its upper Orifice, which has a notable consent with the Heart from their community of Nerves, (both being supplied by the *par vagum* :) and hence a pain here, is called *Cardiaca passio*.

In Man it is but *one* : but such Quadrupeds as *Number*, chew the Cud, especially all that are horned, have *four* Stomachs; the first whereof is called μεγάλη κοιλία, in English the *Paunch*; the second μικρότερον, in Latin *reticulus*; the third ἐχίνος, *omasus*, in English the *Feck*; the fourth ἄνυστρον, *abomasus*, in English the *Read*. Such Fowl also as live upon Corn have two Stomachs; the first membranous, called ἰνγυβίς, the *Crop*; the second carnos, called *ventriculus carnosus*, in English the *Gizzard*. Betwixt these two some name a third, called ἐχίνος, but it seems rather a passage only betwixt these two, than it self a distinct one. But this is not a place to be particular as to the differences of number or shape, &c. of the Stomachs of several Animals, having designed only a succinct Anatomy of Man. But the inquisitive may satisfy themselves in the learned Dr. Charleton's second Prelection before the College of Physicians, entituled *Historia Ventriculi*; or more fully in the ingenious Dr. Grew's comparative Anatomy of Stomachs and Guts, published with his *Museum Regalis Societatis*.

It is seated immediately under the Midriff, *Situation*, which when it is too full it bears against, and so causeth a difficulty of breathing, by hindring the motion of it. In the forepart on the right side, it is covered with the hollow side of the Liver ;
on

on the left side it is touched by the Spleen ; its backside upon full feeding bears against the *vena cava* and spine ; to its bottom length-ways is the Caul knit ; the backside of its bottom resteth on the *Pancreas*, and the fore-side on the *Colon* ; all which further its heat.

Bigness.

The *bigness* of it is commonly such , as is capable to receive so much food at one time, as is sufficient for nutrition. When it is emptied, Dr. *Glisson* says, that it hardly weighs an hundredth part of the whole Body ; so that 'tis a wonder so small a part should cook for the whole. It is less in humane bodies than in Brutes, considering the proportion of their bodies. It is commonly less in Women than in Men. They who have wide Mouths, have large Stomachs.

Figure.

It is longish and pretty round , very much resembling a Bagpipe in shape. It hangs cross the Body ; and its two Orifices , by which the Meat is received in from the Gullet , and let out into the Guts , stand higher up than its middle, so that its upper part makes as it were the concave of an half-moon. It is more capacious on the left side than on the right.

Connexion.

Its left or upper Orifice is continued from the Gullet , by the means whereof it is knit to the Midriff ; and its right or lower Orifice is continued to the Gut *Duodenum*. Its bottom in the whole length of it has the upper edge of the fore-leaf of the Caul adhering to it , by whose mediation it is joyned to the Liver, Back, Spleen, *Colon* and *Pancreas*.

Substance.

The *substance* of it is membranous , that it might admit of distention and contraction. It consists of three *Membranes*. The *first* or outmost is *common* to it and the Gullet , and is derived from the *Peritonæum*. But yet it is not wholly

wholly derived from thence : For as Dr. *Glisson* argues, Seeing this coat is fibrous , and the *Péritonæum* is not ; its Fibres cannot be owing to that , seeing *Nilil dat quod non habet*. These Fibres (being nervous) are streight , running from one orifice to the other , and encompassing both its bottom and sides in their whole longitude. Near the orifices and towards the bottom of the Stomach , they are far thicker than in the sides , insomuch as there they seem in a manner carnous and motory. They cross at right angles the carnous ones lying next under them , as serving not only to cover them , but to bind them fast , and to hinder them from starting out of their ranks.

The *second* or middle coat is *proper* , and fleshy , and consists of two ranks of fleshy Fibres , (with a *Parenchyma* .) The outer rank are the more numerous , and are *transverse* , running cross or round the Stomach ; and under these lie another rank , which (as Dr. *Willis* affirms) upon the top of the Stomach run streight from the left orifice to the right ; but the remainder of them tend along each side of the Stomach obliquely forwards toward the bottom , and meet one another there.

The *third* or inmost is likewise *proper* , but is nervous. On its inner Superficies it is lined with a downy substance , (as the inmost of the Gullet also is) something like Velvet , which appears very plainly after a light boiling of the Stomach. Dr. *Willis* thinks this downy crust to be a distinct coat from the Nervous , because after dipping the Stomach in hot water , it may be easily separated from it : And when it is so separated , because on its outer Superficies , which adheres to the Nervous coat , it is beset with abundance of
ring-like

ring-like Glands, he calls it the *glandulous* coat. When this is removed, the truly Nervous coat appears, which is endued with all sorts of Fibres, but the streight are most numerous. There run abundance of Blood-vessels along it, which terminate in its inner Superficies that adheres to the glandulous coat. So that 'tis probable, the mouths of the Arteries may disgorge somewhat into the Stomach through the glands in which they terminate.

Besides these Membranes with their Fibres, the Stomach hath also a *parenchyma*, especially its middle coat: but it is not sanguineous, but of a peculiar fort. That it has a *parenchyma* is plain; for without one how should the inequalities, that spring from the texture of the Fibres, be filled up? Or whence should all that slimy stuff come, that those who make strings for musical Instruments, scrape off from the small Guts? Doubtless that can be nothing but this *parenchyma* we speak of, seeing after such scraping they have lost nothing of their strength, which they owe to the Fibres and Membranes. And 'tis apparent that the substance of the Guts and Stomach is the same. Some think this *parenchyma* to be almost wholly glandulous.

Orifices.

It hath two *Orifices*: Of which the *first* is on the left side, and is called the *upper*; not because it is situated higher than the other; but because the Meat enters into the Stomach by it, as it goes out by the other, which is therefore called the *lower*. This is wider than the other, because the Meat is only grossly broken by chewing when it passeth through it; whereas it is dissolved into a liquor (called Chyle) when it passes out by the other. It is called in Greek *ασπλα*, *cor*, from whence the region of the Stomach under the

the *cartilago ensiformis*, is called *scrobiculus cordis*, or Heart-pit; and hence also the pains which happen in it, are called *καρδιαλγία*, and *καρδιαγῶν*, because there is a great consent between it and the Heart, by reason that they both of them derive their Nerves from the eighth pair; so that one being affected primarily, the other must suffer by consent. It hath orbicular Fibres, that the Meat and Drink being once received within the capacity of the Stomach, it might be exactly shut, lest fumes and the heat should break out to the hindrance of Concoction, and annoyance of the Head.

The *other* is seated on the right side, and by the Greeks is called *πίλωρ*, *janitor*, or door-keeper, because as a *Porter*, it makes way for the *Chyle* to descend to the *Duodenum*. Here the inmost nervous Coat is very full of wrinkles; and the middle, which is carnous, as every where else, so here also hath two ranks of Fibres; first transverse or annular, to straiten this passage, or shut it upon occasion; and secondly streight, *viz.* such as running length-ways do gather up and draw the rest of the Stomach towards this door, for the distribution of the *Chyle* after it has been sufficiently concocted in the Stomach. And on the contrary, when these Fibres begin to be contracted at the other end, they often draw the *pylorus* towards the left Orifice, as in Vomiting: And when the Convulsion is continued further, the *Duodenum* is drawn upwards, and thence the *Choler* and *Pancreatick* juice are pumpt up as it were into the Stomach. The beginning of the *Pylorus*, where its Coats are thickest, *Dr. Willis* calls its *antrum*.

It hath *Veins*, first immediately from the *trunk Veins*. it self of *vena portæ*, and this is *pyloricus ramus*; secondly,

secondly, from the *branches* of the same, and so from the *ramus splenicus* thereof it hath *gastrica minor*, and *gastrica major* (the largest Vein of the Stomach) from whence *coronaria* springeth; *gastro-epiplois sinistra*, and *vas breve*: and from the *ramus mesentericus*, before it be divided, it hath *gastro-epiplois dextra*. All these Veins, (as the rest of the whole Body) serve only to convey back again (towards the Heart) the remains of the arterial Blood which in the circulation is not spent on the refection and nourishment of the part; though some learned modern Anatomists think, that besides the arterial Blood, they receive some of the more subtile part of the Chyle for its readier conveyance into the mass of Blood, and thence draw a reason of the very quick refreshment that hungry and faint persons receive by eating or drinking.

Arteries.

It hath its *Arteries* from *ramus coeliacus*, which do accompany every Vein, and have the same denomination with them. Most Anatomists are now of opinion, that these *Arteries* do not only convey blood to the Stomach for its nourishment, and for its warmth to help its Concoction; but that they empty out of themselves through the Glands of the Stomach, a certain spirituous liquor into its Cavity, which being joyned with the reliques of the Chyle that stick in its downy Coat, make that juice which is called the *ferment* of the Stomach, which contributes more to the dissolving the Aliments than the *heat* of it, which the Ancients made the main Instrument of its action.

Nerves.

It hath *Nerves* from the *par vagum*, (Dr. Willis's eighth pair) whose trunks passing down (below the pneumonick branches) by the sides of the Gullet, are each divided into *two branches*, the

outer

outer and inner. Both the *inner branches*, by and by bending to one another grow into one, which passing with the Gullet through the Midriff goes on the *outside* of the orifice of the Stomach, and spreads it self in its *bottom*. The two *outer branches* in like manner inclining to each other unite into one, which descending to the Stomach by the *œsophagus*, and arriving at the *inner side* of its orifice, there turns back and creeps through its *upper part*. The *inner and outer branches* as they come one on one side, and another on the other side of the upper orifice of the Stomach, send forth many small twigs, which mutually inosculating make therè a net-like *plexus*. From this *multitude* of Nerves interwoven in the Mouth of the Stomach, proceeds that great consent betwixt it and the Head. (So that in any great concussion of the Head there follows a Vomiting, and from the foulness of the Stomach the Head-ach, &c.) Here at this upper orifice, from the same reason, is the sense of Hunger most urgent. Into the bottom of the Stomach are some twigs inserted that spring from the left *Mesenterical branch* of the Intercoastal Pair.

There are also some *Venæ lactææ* which spring out of the bottom of the Stomach, whose passage from thence to the Common Receptacle, we described before in Chap. 5. from Doctor Wharton. Venæ
lactææ.

Now as to the cause of *Hunger*, omitting sundry The cause
of Hunger. opinions about it, I shall give but that one reason of it, which *Diemerbroeck* thinks the most probable, and thus expresses: "It is caused from fermentaceous (or dissolving) particles partaking of acrimony, bred of spittle swallow'd and other saltish or acid things eat or drunk, which sticking to the coats of the Stomach, and
"brought

“brought to some acidity by it, or remaining
 “in it after the Chyle is sent off, affix’d to its
 “inmost wrinkled Membrane (especially about
 “its upper orifice) molest it by their twitching,
 “which twitching being communicated to the
 “Brain by the Nerves of the eighth pair, an ima-
 “gination of taking meat is excited to allswage
 “that troublesome corrosion.] He that doubts
 of the truth of this opinion, may find it evinc’d
 at large in his *Anatome corporis humani*, cap. 6.
 pag. 39, &c.

The action
 of the Sto-
 mach.
 Chyle.

The action of the Stomach is *Chylification*. Now
 Chyle is a pretty thick white juice like Barley-
 cream, made out of the aliments taken; the man-
 ner whereof is well exprest by the same Author.
 “While the meat is chewing in the Mouth, it
 “is mix’d with the *saliva*, which not onely sof-
 “tens it, but endows it with a certain fermenta-
 “tive quality, unto which contributes also the
 “drink, (whether Beer, or Wine, or some other)
 “which often contains in it acrimonious parti-
 “cles and fermentaceous Spirits. The Stomach by
 “the help of its Fibres embraceth closely the
 “Meat thus chew’d and swallow’d, and mixeth
 “therewith Specifick fermentaceous juices,
 “bred in its inner Coat, and impregnated with
 “the *saliva*. Then by a convenient heat there
 “is made a mixture and eliquation of all; for
 “that the fermentaceous particles entring into
 “the Pores of the Meat, do pass through, agi-
 “tate and eliquate its particles, dissolving the
 “purer from the crass, and making them more
 “fluid, so that they make another form of mix-
 “ture, and unite among themselves into the re-
 “semblance of a milky cream; after which, to-
 “gether with the thicker mass, with which they
 “are as yet involv’d, by the constriction of the
 “Stomach

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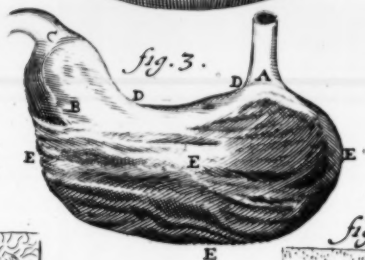
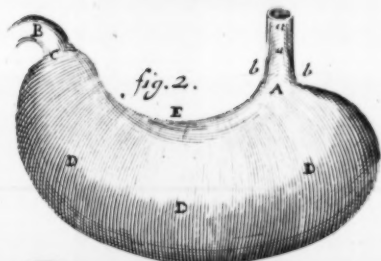
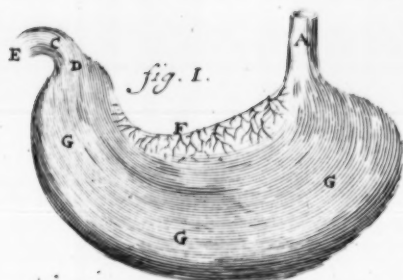


fig. 4.

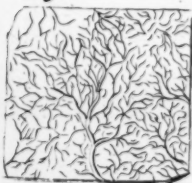
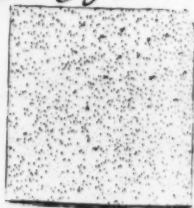


fig. 5.



"Stomach they pass down to the Guts, where
 "by the mixture of the Bile and the pancreatick
 "juice, they are by another manner of fermentation quite separated from the thicker mass,
 "and so are received by the lacteal Vessels,] as the thicker is ejected by stool. This seems to me a very rational account of Chylification, and of the ferment by which it is chiefly performed; unless there ought to be added another Ingredient to compose the ferment, viz. the Air, whose particles are plentifully and intimately mixed with the Meat in chewing, and swallowed with it. See farther of the action of the Stomach in Dr. Charleton's third Prelection before the College of Physicians, Sect. 6. p. 112.

Tab. II. Representeth the several Coats of the Stomach with their Fibres, from Dr. Willis.

Fig. 1. Expresses the outmost nervous Coat of the Stomach, whose nervous Fibres running length-ways of it, cut the outer carnos ones that lie under them, at almost right angles.

A The Gullet, in whose outer Coat all the nervous Fibres descend streight, crossing obliquely the carnos ones that lie under them.

B The mouth of the Stomach.

C The Pylorus with its antrum D. and a portion of the Duodenum continued from it E.

F The upper part of the Stomach, where the Blood-vessels appear very numerous.

GGG The nervous and slender Fibres running length-ways of the Stomach from one Orifice to another, and further each way.

Fig. 2. Shews the Stomach divested of its utmost
 E nervous

nervous Coat, that the outer or convex Superficies of the middle Coat with its carnous Fibres may appear.

A The mouth of the Stomach into which the Gullet aaa is inserted, and which the circular carnous Fibres bbb encompass, shutting it upon occasion by contracting themselves.

B The Pylorus with the Duodenum continued to it.

C The Orifice and antrum of the Pylorus, both which, the circular Fibres, when they are contracted, straiten, and seem to shut.

DDD The circular Fibres encompassing the Stomach depthways.

EEE The top of the Stomach, where these Fibres springing, whilst they are contracted draw towards it the whole bulk of the Stomach very much strained.

Fig. 3. Shews the Stomach turn'd inside outward, that the downy Crust with the wrinkles and folds may be seen.

A The left Orifice of the Stomach.

B The antrum of the Pylorus, in which the Coats are thicker.

C The right Orifice to which the Duodenum is continued.

DD The top of the Stomach betwixt the two Orifices.

EEEE Its sides, end and bottom, in which the downy crust of the inmost Coat, with the wrinkles and furrows therein, are exprest to the life.

Fig. 4. Represents a piece of the nervous Coat, in which, the downy Crust being removed, its inner or concave Superficies appears, with a very thick branching of Vessels.

Fig. 4.

Fig. 5. Shews a piece of the downy or glandulous coat, in which its outer Superficies, that cleaves to the nervous Coat, appears very full of Glandules and the mouths of Vessels.

C H A P. VIII.

Of the Intestines, or Guts.

THE Guts are called in Latin *Intestina*, in The Guts:
Greek *έντερά*, and *σπένδερά*, from their being Their
placed within the Body. Name.

They are oblong, Membranous, hollow, round, Figure.
diversly twisted, continued from the *pylorus* to
the *podex*, for conveying the Chyle, and the ex-
crements of the first concoction.

They are knit together by the Mesentery, by Connexion:
which and by the intervention of the Caul, (part
of which adhereth to the beginning of the *Duo-*
denum, and the middle part of the *Colon*) they
are tied to the Back, and fill the greater part of
the Cavity of the *Abdomen*.

They are of a membranous Substance:
substance like the Stomach, thinner in the small Guts, and thicker
in the great; and the nearer they come to an end,
the thicker they are, as the lower end of the *Co-*
lon, and the *Rectum*.

The Length:
length of the Guts is about six times the
Party's length whose they are. They are thus
long (and winding) that the concocted Aliments
passing out of the Stomach, by their long stay in
the Guts, might the more commodiously be fer-
mented by the admixture of the bile and pancre-
atick juice; and so the more subtil chylous parts
being separated from the thicker mass, might be
the better and more leisurely driven into the

narrow Offices of the lacteal Vessels, partly by the proper peristaltick motion of the Guts, and also by the Impulsion of the Muscles of the *Abdomen* moved in respiration. And hereby two great inconveniences are avoided; the one of eating almost continually, which would have follow'd from the Chyle's not having time enough to have its particles separated and distributed, before it would have arrived at the *anus*, whereby the Body must needs receive but small sustenance from any thing eat or drunk; the other (for the same reason also) of having almost a continual need of going to stool; as happens to such voracious Animals as have a streighter passage from the Stomach to the *anus*.

Coats.

They have three *Coats* like the Stomach. The *outmost* is *common*, and is derived from the *Peritoneum*, but mediately; for in the *Duodenum*, and that part of the *Colon*, which runneth under the Stomach, it proceedeth immediately from the membranes of the Caul, which is knit to those Guts; and in the *Jejunum*, *Ileum*, the rest of the *Colon*, the *Cacum* and *Rectum*, it proceedeth from the Membranes of the Mesentery. It is all over besear'd with Fat, and is truly nervous.

The other two *Coats* are *proper*. The *outer* of them, being the middle of the three, is carnosus. It has two ranks of moving Fibres, one lying under the other; The first and inner rank is annular or transverse, which encompassing the whole cavity of all the Intestines in very close order, is inserted into the hem or selvedge of the Mesentery as into its Tendon. The other rank is of straight Fibres, which being spread above the former, and cutting them at right angles, reach along the whole length of the Intestines; and their Tendon seems to be the *outmost* coat, which

which being wholly nervous, or as it were tendinous, is wrapt about the whole rank of these Fibres.

The *innermost* is nervous, although it seem to be fleshy, by reason of the crusty substance with which it is lined. This lining is called by *Pecquet* a spongy *peristoma*, by *Bilsius* a woolly *mass*; it serves as a Filter for the Chyle to transcolate through in order to its entrance into the *vena lactea*; and besides, it hindreth excoriation, which might be caused when sharp humours pass through the Guts. Some (as particularly *Dr. Willis*) take it for a distinct coat, and call it *glandulosa tunica* or *villosa*; being altogether like that of the Stomach, which is described in the foregoing Chapter, and having the same use with it.

This Membrane in the small Guts, especially the *Ileum*, is full of wrinkles, to stay the Chyle from passing too soon; which wrinkles are caused, for that this inmost coat if it be sever'd from the former and the wrinkles stretch open, will be (according to *Fallopianus's* observation) thrice as long as it. And the same Membrane is expanded in the *Colon* into little cells, for the slower passing of the *feces*. These wrinkles in both are called by * *Kerkringius*, *valvulae conniventes*. It * *Hick.* has all sorts of Fibres, and contains the mouths of all the Vessels both sanguineous and lacteal, which are cover'd with that spongy crust before-mentioned. *of Anat.* xxxvii. p. 85.

What was said of the *Parenchyma* of the Stomach in the foregoing Chapter, may without repeating it here, be applied to the Guts likewise.

Many late Anatomists have observed abundance of *Glands* to stick in this inmost coat, (besides those which make *Dr. Willis's* glandulous coat) but they have been treated of by none, I

think, so exactly as by *Peyerus*, who has writ a small tract of them, and describes them thus. " They are very soft and delicate as to their substance, *he says*, so that if one handle them ruggedly, they are easily squeezed and defaced. " They cannot be seen on the outside ; but if one slit open the Gut lengthways, and thrusting his finger against the outside, press the inside out by the slit, and hold it to the light, they plainly appear like little teats, with each one a small pore in its top toward the cavity of the Gut, as their bases or backsides have blood-vessels, (and as he says, Nerves too) inserted into them. If one press with his finger on their backside, there will issue out of their pore a clammy humour. There are but very few (sometimes none) of them in the *Duodenum* or *Jejunum*, but they are most numerous in the *Ileum*, especially towards its lower end, and they are chiefly on that side of the Gut that is opposite to the adhesion of the Mesentery. Where they are, they are not single, but a knot or cluster of them together, whence (as also from their use) he reckons them in the number of *conglomerate glands*. They are thus in knots in the small Guts; but in the *Cacum*, *Colon* and *Rectum* they stand single, but are larger than the other, with every one a pore in it likewise. These are almost as big as a Vetch (and of the same shape) but those in the small Guts are but about the bigness of Millet. He thinks the office of those in the small Guts is to separate a double sort of liquor, viz. a subviscid and glutinous serum from the Arteries, and a nitro-aereous spirit from the Nerves, (according to Dr. *Mayow's* opinion) " which two being mixt together make a fermentative liquor for the perfecting

“fecting of chylication in the Intestines. But
 “those in the *thick Guts*, he says, serve for little
 “else but to spue out a clammy humour, by
 “means whereof the Guts are fenced against the
 “hardness of the excrements, &c. and also the
 “particles of the excrements themselves are
 “thereby glued together, as it were, into a due
 “consistence. Yet he suspects there is something
 “of a nitro-aereous spirit also mixed with this
 “humour, and thinks it most probable that the
 “*flatus* in the *Colon* owe their origin thereto.]
 Thus he.

As to their *Vessels*, the *Veins* spring from the *Veins*.
Porta, but not all of them from the same branch:
 For the *duodenalis surculus* is sent into the *Duode-*
num, and the *Hæmorrhoidalis interna* to the left
 part of the *Colon* near its ending, which running
 downwards from thence under the *Rectum* is in-
 serted into its end or *anus*; as the *dexter mesente-*
ricus is sent to the *Jejunum*, *Ileum*, *Cæcum*, and
 the right part of the *Colon*. *Epiplöis postica* is in-
 serted into the middle part of the *Colon*, which
 marcheth across under the Stomach. Besides
 these, a sprig from the *ramus hypogastricus* of the
Vena cava is sent to the Muscles of the *intesti-*
num Rectum, which maketh the *external hæmor-*
rboidal.

The Use of these Veins inserted into the Inte-
 stines the Ancients thought to be, both to carry
 venal blood to them for their nourishment, and
 also to receive the Chyle out of them and carry
 it to the Liver there to be turn'd in blood. As
 to the first use, 'tis certain (by the circulation of
 the blood) that these Veins carry nothing to the
 Guts; but the blood that is in them, is all recei-
 ved from the Arteries there, to be carried back
 towards the Liver, and so to the Heart: but as

Their Use.

to the latter, there are some learned Anatomists that still think, though the greatest part of the Chyle is received by the *vena lactea*, yet that some part is suckt in by these Veins, that it may be more readily conveyed into the mass of blood. But this opinion is exploded by others as learned and more numerous, who deny any such office to them, to whom I subscribe.

Besides these sanguineous Veins there are another sort of Veins inserted (more or fewer) into all the Guts, called *Lacteal*, but of them we will treat in a distinct Chapter.

Arteries.

The *Arteries* spring partly from *ramus celiacus intestinalis*, partly from both the *mesenterica*. To the *Duodenum* and the beginning of *Jejunum*, a sprig is sent from the right *ramus celiacus*: but to the rest of the *Jejunum*, to *Ileum*, *Cacum* and the right part of *Colon*, *mesentericus superior*; to the left part of *Colon*, and to the *intestinum Rectum*, *mesentericus inferior*. This last, passing along the *Rectum* to the *Podex*, makes the *internal hæmorrhoidal Arterie*, as some branches from the *arteria hypogastrica* make the *external*. Lastly, *epiploica postica*, which riseth from the lower part of *arteria splenica*, (which is the left branch of *arteria celiaca*) is sent to the middle part of the *Colon*, which lieth under the *Stomach*.

Their Use.

Their *Use* is to convey nourishment and warmth to the Guts; and when the Body is morbose, to carry thither the impurities of the blood, upon a purge taken, or critically, so to pass out by stool. Yea, 'tis very probable, according to *Peyerus* his opinion before-cited, that such *Arteries* as terminate in the glands above-described, do spue out through them into the Guts, even in a healthful state, that slimy humour that bedaubes the inside of them.

Nerves

Nerves they have from the inferiour ramifications of the *Intercoſtal* or ninth pair. The *Duodenum* hath ſome twigs from the upper branch of the *ramus meſentericus* called *ſtomachicus*, which go alſo to the *Pylorus*. All except the *Reſtum* have many twigs chiefly from the *plexus meſentericus maximus*, and ſome alſo from other *Meſenterical plexus* of the *Intercoſtal* pair; but the *Reſtum*, with the lower end of the *Colon*, receive ſlips from the *plexus Abdominis infimus* or *minimus*; and the utmoſt extremity of the *Intercoſtal* is inſerted into the *ſphincter ani*, whither alſo paſs three or four that ſpring from the bottom of *Oſ ſacrum*.

Theſe Nerves ſerve for the feeling, and for the periltaltick or worm-like motion, of the Guts; which though it be obſcure and ſlow, yet becauſe it is continual, it had need of, ſo great a number of Nerves or nervous fibres as are beſtowed on the Inteſtines. Now this motion is in ſome meaſure performed by the oblique fibres, but eſpecially by the tranſverſe, whereby what is contained in them is driven from above downwards: unleſs it happen that the motion be inverted, as in the *Iliack paſſion*, in which they drive their Contents from below upwards. *Peyerus* thinks that even in a natural ſtate (at leaſt in the ſmall Guts) this motion is reciprocal, the contractions of the fibres being carried ſometime upwards, and ſometimes downwards; to the end that both the fermentative liquors may by this agitation be the more intimately mixed with the chylous maſs, and alſo the chyle the better diſtributed into the *Lacteal veſſels*. If it were otherwiſe, the deſcent of the chyle, he thinks, would be ſo haſty, that every one would labour under the *celiaca affectio*. And he quotes from *Weſper* an Inſtance in an humane

mane body, and alledges his own observation in all his dissections of Creatures alive, for the confirmation of the truth hereof. But the learned and curious that would be further informed about the peristaltick motion, may consult Dr. *Glisson* in cap. 15. of his Book *de ventriculo & intestinis*, or Dr. *Charleton* in Sect. 3. of his third prelection before the College of Physicians. As for that other Use, which *Peyerus* ascribes to the Nerves, of transmitting a nitro-aereous spirit through the Glands into the Guts, which mixing with that humour that is separated from the Arteries makes a ferment for the perfecting of chylication in the Intestines, the Reader is at his discretion what opinion he will entertain of it.

The division of the Guts.

Though the Guts be one continued Body from the *pylorus* to the *anus*, yet from the thickness of their substance, as also from their magnitude, figure, and variety of office, they are distinguish'd into several by Anatomists, and first into *thin*, and *thick*.

The differences between the *thin* and *thick* Guts are thus summ'd up by *Aquapendent*: "The *thin* or *small* are placed above, are long, equal, round, rolled about in wreaths, full of wrinkles, interwoven with innumerable Veins, and Chyle is found in them: On the contrary, the *thick* are placed below, are short, anfractuons, without twisting wreaths, and endued with fewer Veins; and the wrinkles or folds in the Guts are expanded, and there result from them certain recesses or cells, and the *faces* are found in them.

The thin.

The *thin* possess the umbilical region and *hypogastrium*; and in respect of their figure, situation, longitude and plenty of lacteal Vessels, they are

are divided into three, viz. the *Duodenum*, *Jejunum* and *Ileon*.

The first is called *Duodenum*, because the Ancients thought it to be *twelve* inches long. But being chiefly vers'd in the dissection of Brutes, they were thereby deceived; for though in Sheep, for instance, it be of that length, yet in Man it is but about four fingers. It is continued from the *pylorus*, from whence turning backwards and downwards it reaches to the middle of the greater and right end of the *Pancreas*; and is none of it knit to the Mesentery, but to the fore-leaf of the Caul. It is thicker in its Membranes than the two following small Guts, but its passage (because straight) is straiter than theirs. Towards its lower end, (sometimes higher, sometimes lower) it has most commonly two ducts leading obliquely into it; first the *ductus choledochus communis*, by which the bile from the Liver enters this Gut; and secondly a little below this, *ductus pancreaticus* (otherwise *Wirsungianus*) by which the pancreatick juice passes hither from the *Pancreas* or Sweet-bread; though these two ducts are sometimes joined into one, and both open by one mouth into this Intestine.

The second is called *Jejunum*, or the hungry Gut, because it is for the most part found empty; partly by reason of the multitude of milky Veins that enter it; partly by reason of the fermentation of the acrimonious choler with the pancreatick juice, which are both poured in just before its beginning. In length it is about eight feet. It beginneth on the right side, under the *Colon*, where the *Duodenum* endeth, and the Guts begin to be wreathed; and filling a good part of the umbilical region, especially on the left side, it is continued unto the *Ileum*, from which it may be distinguish'd

distinguish'd first by its emptiness, secondly, by its greater number of Veins and Arteries, from which it looks reddish; thirdly, from the nearness of the folds or wrinkles of its inmost coat one to another, which are but about half an inch distant, whereas in the *Ileum* they are a whole inch or more; and lastly, from the thickness of its coats, as being thicker than those of the *Ileum*.

3. *Ileum*. The third is called *Ileum*, ἐπὶ τῷ εἰληθῶς , *à circumvolvendo*, from its many turnings and windings. It hath thinner membranes than the two before-going. It is seated under the Navel, and filleth both the *Iliæ*. It is the longest of all the Guts, for in length it containeth above twenty feet; but it is the narrowest of all, for it is but about a finger's breadth in diameter. It hath fewer wrinkles than the *Jejunum*, and lesser; about the lower end of it they scarcely appear.

At its beginning it is distinguished from the *Jejunum* by all the four particulars above mentioned; and it is easily distinguishable from the *Cæcum* or *Colon*, being not joyn'd to these by a streight duct, but transverse. For the *Cæcum* and *Colon* are so united as to make one continued streight Canal, whose lower side the *Ileon* ascending pierceth, and into the latter whereof its inner Coat hangs loosely the length of half an Inch at least, making the Valve it self of the *Colon*, and is the limit that divides the *Cæcum* from it.

This *Ileum* oft falls down into the Cod, whence such a Rupture is called Intestinal. And in this Gut happens the Distemper called *Volvulus* or *Iliaca passio*, wherein there is often vomiting of the dungy Excrement. This Distemper is caus'd herein, either when one part intrudes into another, or when the Gut is twisted and twined
like

like a Rope, or when it is stuff'd with some matter that obstructs it : or lastly , when it falls out of its place into the *scrotum* , as was noted before. And thus much of the first sort of Intestines, *viz.* the *small* or *thin*.

I have once and again made mention of the *Their* wrinkles in the inside of the *Jejunum* and *Ileum*, *valves*, which by modern Anatomists are called *Valvule conniventes*. These happen from these Guts inmost Coats being much longer than the two other ; for hence it must needs ever and anon wrinkle or bag out, and where it does so, straiten the passage , by which means the Chyle descends more slowly , and thereby the Lacteal vessels have the more time to imbibe it.

Now follow the *intestina crassa* , the *thick* or *The thick* great Guts ; they are three in number also. *Guts.*

The first is called *Cæcum* , *τυφλόν* , the *blind* *1. Cæcum.* Gut , because one end of it is shut , so that the Chyle (or *feces* rather) both goes in and comes out at the same orifice. In Man it is about as thick, and but half as long, as your larger Earthworms stretched out at length ; only its mouth that opens towards the *Colon* is pretty large. It owes its origine rather to the *Colon* than the *Ileum*, and seems to be as it were an appendage to it. It is bigger in an Infant than in a Man. It is not tied to the Mesentery , but being placed in the Cavity of the right *os Ilium* , by its end it is joyned to the right Kidney , the *peritoneum* coming between. In sound persons it is generally empty. In four-footed Beasts it is always full of Excrements. Apes have it larger than a Man , Dogs larger than Apes ; but Conies, Squirrels, and Rats, largest of all, if you consider the proportion of their Bodies. Its use is very obscure in Men , being so very small and commonly

commonly empty. But in grown *fœtus's*, or Infants new born, it is full of Excrement, for which it serves as a Store-house till after the birth that they go to stool. And in such Animals as have it large, (according to Dr. *Glisson*) it serves for a Bag or second Ventricle, wherein the prepared Aliments may be stored up and so long retained, till a richer, thicker, and more nutritive juice may be drawn from them.

2. Colon. The second is *Colon*, *κόλον*, either *quasi* *κόλον*, *cavum*, because it is the *hollowest* or widest of the Guts; or else *ἐπὶ τῷ κωλύειν*, *ab impediendo*, because it *detaineth* the Excrements. It hath its beginning at the *os Ilium* on the right side, and ascending by its Spine it arrives at the right Kidney; to which parts it is annex'd by a membranous connexion. From thence bending left-ways it creeps under the Liver by the Gall-bladder, (which tinges it there a little yellowish) to the bottom of the Stomach, to the whole length whereof it is tied by the mediation of the fore-Leaf of the Caul, as it is knit also to the *Pancreas* and Loins by the mediation of the hinder Leaf. Then it comes to the lower part of the Spleen, and is knit to it. Then touching the left Kidney, and adhering firmly to it by Fibres, it comes to the left *os Ilium*; from which descending by the left Groin to the *pelvis* it embraceth the bottom of the Bladder behind on each side. Afterwards it ascends upwards by the right Groin near the place from whence it first took its rise; and thence marching back again towards the left side, and running it self in betwixt the *Ileum* and Back-bone, it reaches to the top of *os Sacrum*, and there unloads it self into the *Rectum*. Its length according to Dr. *Glisson*, is about seven feet; others reckon

it shorter. It goeth almost quite about the *Abdomen*, next to the Muscles, that it may be the better compressed by them for avoidance of the Excrements. *Diemerbroeck* has an ingenious reason why it should pass under the Stomach; viz. That as Chymists judge no digestion more natural, than that which is performed by the heat of Dung, so the heat of the Excrements in the *Colon* does help the coction of the Stomach.

It is not of one continued equal width, but at about every two or three Inches distance it is more contracted, being somewhat furrow'd on the outside, and ridged on the inner, whereby the Gut is divided into several *Cells*. This comes to pass partly indeed from the inmost Coat's exceeding the middle and outmost somewhat in length, but chiefly from the *Ligament* (which is half an inch broad) that runneth on the upper and middle part of this Gut all along, and is much shorter than the membranes of the Gut, as appeareth when it is cut through here and there, for then the Gut may be stretched out to near half as long again. The Use of these *Cells* is to hinder the flowing of the excrements into one place, which would compress the parts adjacent; as also for the slower passage of the *feces*, that we may not have a continual and hasty need of going to stool. On its outside, especially from its passing by the Spleen to its joyning to the *Rectum*, it has a great many fatty knots, which serve to moisten and lubricate it, that the *feces* may pass the more glibly. The *Rectum* also has such like, for the same reason.

It hath a *Valve* where it is joined with the *Ileum*, which Valve is nothing else but the inmost coat of the *Ileum* propending or hanging out flabby into the *Colon*, (as was noted before :) For its shape,
Spigelius

*Its Cells
and Liga-
ment.*

Its Valve.

Spigelius compares it to the *sigmoïdes* in the right *sinus* of the Heart. This Valve so stoppeth the hole which is common to the *Ileon* and *Colon*, that flatuofities cannot ascend from this latter into the former, much less excrements regurgitate. But if the peristaltick motion of the Guts be inverted, (as in the *Iliack* Passion) so that the inmost coat of the *Ileum* be drawn back from its depending into the *Colon*, the excrements of the *Colon*, yea Clysters themselves may ascend up thro' the small Guts into the Stomach, and be thrown up by vomit.

3. *Rectum*.

The third is *intestinum Rectum*, the *streight* Gut. This hath its beginning at the first *vertebra* of the *Os Sacrum*, where the *Colon* endeth; and passeth streight downwards to the extremity of the *Coccyx*. It is fast tied on its *back-side* to both these bones, by mediation of the *Peritoneum*, to keep it from falling out; and on its *fore-side* it grows in *men* to the neck of the Bladder, (whence in the pain of the Stone there, there generally happens a *tenesmus* or continual inclination to go to stool) and in *women* to the neck of the Womb: but in both there is a musculous substance that comes between. It is a foot in length, not so wide as the *Colon*, but its Membranes are thicker.

Its Sphincter Muscle.

At its lower end, (called the *Fundament*,) it has a *Sphincter Muscle*, by the help whereof it is close pursed up, to hinder the continual exit of the *faces*. But in going to stool the same is partly voluntarily relaxed, and partly forced open by the excrements themselves whilst they are squeezed or forced down through the compression of the Guts by the contraction of the *Abdominal* Muscles.

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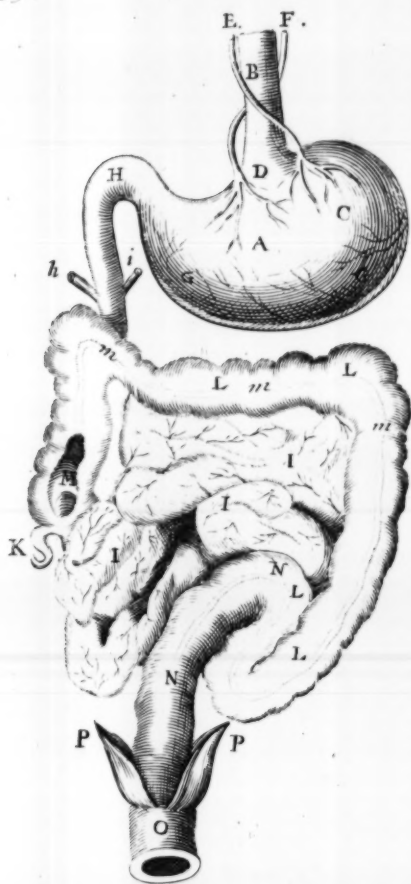
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This Gut (especially its inner Membrane) usually bags a little out in straining at stool, or upon taking Aloetick Purgers, yea sometimes so much, that it requires an artificial putting up again.

As for the *hæmorrhoidal* Veins and Arteries, that are inserted into the *anus*, we have given an account of them before in this Chapter; as we shall do of the *Muscles* belonging to it, in Book V. of the *Muscles*, Chap. 19.

The Explication of the Figure.

- A The Stomach.
- B The Gullet or Oesophagus.
- C The left and larger part of the Stomach.
- D The upper orifice of the Stomach.
- E The right external Nerve of the sixth pair (Dr. Willis's eighth) encompassing the orifice.
- F The left external Nerve of the same pair.
- GG The gastrick Vessels creeping along the bottom of the Stomach.
- H The lower orifice of the Stomach, called pylorus.
- h The insertion of the Gall-passage into the Duodenum.
- i The insertion of the Pancreatick duct into the same.
- III The Jejunum and Ileum with the Vessels creeping along them.
- K The Cæcum.
- LLLL The Colon.
- M The Valve in the beginning of the Colon opened.
- mmm The Ligament bolding together the Cells of the Colon.
- NN The Rectum.
- O The Sphincter of the Anus.
- pp The Muscles called Levatores Ani.

C H A P. IX.

Of the Mesentery.

The Mesentery.

Its name and description.

THE Mesentery is so called from its situation. For it has its Greek name *μεσεντερ*, (from whence the English is derived) from its being placed *ἐν μέσῳ τῶν ἐντέρων*, in the midst of the Intestines. And it is a membranous part, situated in the middle of the lower Belly, serving not only for conveying some Vessels to the Intestines, and others from them, but also ties most of the Guts together so artificially, that for all their manifold windings they are not entangled and confounded. Which may be much wondred at, how the Guts being about nine or ten yards long, should all but the *Duodenum* and part of the *Rectum* be comprehended by that circumference that is but a span distant from the centre; for no longer is the Mesentery betwixt those bounds. But it is almost of a circular figure, which is most capacious; and though it be narrow and plain at its rise, yet its circumference is wrinkled and enlarged into so many folds, as to be three Ells in length, whereby it comes the nearer to answer the length of the Guts.

Rise.

It has a double Origine, an higher, and a lower. The higher is at the first, and the lower at the third *vertebra* of the Loyns.

Substance.

It is composed of two common Membranes which are propagated or continued from a duplicature of the *peritonæum*; and betwixt these two it has a third Membrane that is proper, (which was first discover'd by Dr. *Wharton*, in a young Maid) and is thicker than either of the other

other two, wherein the Glands are seated, and by which the Vessels are conducted.

As for the *Fat* with which it is stufft betwixt its Membranes, though the same happen naturally to it, yet ought it not to be reputed a proper part of it. For not to mention that in Dogs, Cats, and such like Animals, this part is very thin and transparent, even in humane *Embryos* it is without Fat; and in very lean Men there is but little, though in fat Men it be heaped up to so great a thickness.

The parts contained in the Mesentery are *ci-Party*; ther common or proper. The *common* are Veins, Arteries, Nerves, and Lympheducts. The *proper* are Glands and the *Vena lactea*. Of these last we shall speak in the next Chapter, of the rest here.

The *Veins* are called *Mesaraica*; these spring *Veins* from *ramus mesentericus dexter & sinister*, branches of the *vena Portæ*. (Their use, as also that of the Arteries, was shewn in the Chapter before, speaking of the Vessels belonging to the Guts.)

It hath also two *Arteries*, the one superiour, the other inferiour, branches of the *arteria mesenterica*, *Arteries* which pass as the Veins do.

As for the *Nerves*, Dr. Willis describeth them *Nerves* very accurately in his Book *de Cerebro*, cap. 25. which take thus in short. "As soon as the *inter-costal pair* is descended as low as over against the bottom of the Stomach, it sends forth on each side a large mesenterick branch, each of which is again divided and makes two *plexus* in each side. In the middle of these is the greatest *plexus* of all, which (as he speaks) is like the Sun amongst the Planets; from which, twigs and numerous Fibres are dispersed into all the parts of the Mesentery, which accompanying the sanguiferous Vessels in their whole process,

“do climb upon and twist about them.] Others it hath from those which spring from the *spinalis medulla*, between the first, second, third, and fourth *vertebræ* of the Loins, (as *Spigelius* affirmeth.)

*Lympe-
ducts.*

Besides these Vessels known to the Ancients, about 38 years ago there were found out another sort by *Tho. Bartholin* (a learned Dane) and called by him *vasa lymphatica*, which he gives a large account of in *Append. 3. to the libel. 1. de Pect.*, of which I shall give a *Compendium* here, because the Mesentery abounds with them.

*Their Fi-
gure.*

They are of figure long and hollow like a Vein, but very small and knotty, having very many Valves which permit the *lymphæ* or water contained in them to pass to the chyliciferous Vessels (and many Veins) but hinder its return.

*Colour and
Substance.*

They are of a pellucid and crystallin colour, like *hydatides*, consisting of a transparent and most thin skin, which being broken, and the *lymphæ* flowing out, utterly disappears.

Number.

Their number cannot be defin'd, for they are almost innumerable.

Rise.

As to their rise, *Bartholin* speaks uncertainly; but *Malpighius* affirms, that they always proceed from Glands; and *Steno*, that they always either arise from or are inserted into Glands.

Insertion.

As to their insertion or ending, those under the Midriff do discharge their liquor into the *receptaculum chyli*, (to be spoken of in the next Chapter.) Those in the *thorax*, immediately into the *thoracick duct*. And those of the Neck, Arms, &c. into the jugular Vein. *Bartholin* thought they all discharg'd themselves into these three Channels: but *Diemerbroeck* affirms, they open also into many other Veins; and quotes *Steno* noting that they empty themselves into the jugular and

and other Veins; and also his Countryman *Frederick Ruysch* writing, that by ligature and structure of the Valves, he has plainly seen, that all the lympheducts in the Lungs do discharge their *lymph*a into the subclavian, axillar, and jugular Veins.

Steno distinguishes them into three sorts; for some from their first Origins (but what those are, he cannot say) are dispersed over the surface of the first Glands they approach unto; others run from the hollow side of one Gland to the gibbous of another; and a third sort run from the hollow side of these latter, to the Veins into which they discharge their *lymph*a. Whence (supposing this difference) an Inquiry may arise, Whether the lympheduct that passes out of the hollow side of the Gland, carry a more elaborated *lymph*a than that which entered into its gibbous side? or whether only the quantity be increased? I believe that into every Gland there enter an Artery, Vein and Nerve, and therefore that some new *lymph*a is added to that which was brought in from the Lympheduct inserted into it, which together therewith enters into the Lympheduct arising out of it; but that there is no further elaboration of the former *lymph*a, which I think perfect at its entrance into the first Lympheduct.

There has been much dispute what this *lymph*a which they carry, is. It seems to *Bartholin* to be meer limpid water; but to simple water there is added an alimentary liquor, or a thinner part of the Chyle, fit for Nutrition, thoroughly mixed with it. The former, he says, is cast off either by sweat, or other ways whereby water passes away; the later is circulated on. *Glosson*, that it is a liquor condens'd from the *halitus* of the

blood (like Dew) driven into these Vessels, and flowing back with the vehicle of the aliment brought by the Nerves. *Segerus* (and *Sylvius*) that it is the animal Spirits, or is made of them, which after they are distributed into all parts by the Nerves, are there partly consum'd and dissipated, and are partly condens'd into this water. *Diemerbroeck* quotes more Opinions besides these, but rejects them all, and establisheth this of his own, *viz.* "That it is a fermentous liquor separated from the serous part of the blood in the conglobate Glands, yet not simple, but impregnated with much fus'd and volatile Salt, and also with some sulphureous particles; which when it is conveyed to the *vasa chyli*fera, makes the Chyle thinner and apt to dilate easily in the Heart; and when to the *Veins*, prepares the venous blood (now too thick) for a quick dilatation in the Heart.] This *lympha*, whatever it be, (or be for) differs from the *serum*; for if one gather a little of it in a Spoon, and let it stand, without setting it on the Fire, it will turn into a jelly, which the *serum* will not do.

And thus much of the *Lympheducts* (with their *lympha*) in general; as to those particularly of the Mesentery, some only pass through it from other parts, as from the Liver, &c. but many have their rise in it, and both the one and other are emptied into the *receptaculum chyli*.

The Glands of the Mesentery.

It hath many little softish Glands fix'd in its proper Membrane, cover'd on each side by the two common ones, and beset with Fat. If you cut them in two, and press them with your Fingers, you may squeeze a whitish liquor out of them. They are whiter in young people than
in

in old. In number they are very uncertain ; in Man fewer and smaller also than in other Creatures. The biggest by much is at the rise or centre of the Mesentery , (called by *Asellius*, *Pancreas*) into which all the *venæ lacteæ* are inserted. Of its use, as also of the lesser , we shall speak in the next Chapter , when we come to treat of the passage of the Lacteals. We will only note here , that when these Glands grow scirrhus , or are any ways obstructed , so that the Chyle cannot transcolate through them, there follows a *fluxus caliacus*, or *chylosus* , which continuing, there ensues an Atrophy , and the party dies tabid. And perhaps from the same Obstruction in the Glands, the course of the lymphæ being stopped , and by that means the Lympheducts that pass from one Gland to another being over-extended and bursting , an *Ascites* is partly caused.

It is but one, yet because of its different thickness it is divided by some into two parts. The division of the Mesentery.

The one they call *Mesaraeum*, *μεσαραιον*, because it is placed *ἐν μέσῳ τῆς ἀραιῆς* (*subaudi ἐντέρον*) in the midst of the small Intestines , which it knits together ; and this is the thicker part of it. The other being the thinner , they call *μικρότερον*, being seated *ἐν μέσῳ τῆς κόλης* , in the midst of the Colon, to which it is joyned in its whole length, save only in the Colon's passage under the Stomach ; and in its lowest border it adheres to a part of the *Rectum*.

Diseases incident to this part are reckoned up by Dr. *Wharton* to be these ; those of intemperies, straitness or obstruction , tumours of whatsoever kind, (*Scirrhi*, *Scrophulæ*, *Strumæ*) Inflammations, Abscesses, Ulcers, and Tone vitiated.

Of all which the Reader that desires fuller information, may be satisfied by the said learned Author, in his *Adenographia*, cap. 11.

CHAP. X.

Of the Venæ lactææ, Glandulæ lumbaræ, Receptaculum commune, ductus chyli-ferus Thoracicus, and of the motion of the Chyle.

Venæ lactææ, the *Milky veins* (so called from the white colour of the Chyle which they carry) were not discover'd (as such) till the year 1622. when *Caspar Asellius* found them out in dissecting a Live-dog well fed. But since him many others have made a more accurate discovery of them than he.

Definition. They are slender pellucid Vessels, having but a single Coat, dispersed in great numbers thro' the Mesentery, and appointed for the carrying of the Chyle.

Rise. Their *rise* is from the inmost Membrane of the Intestines, where their Mouths are hid under a kind of a spongy crust or *mucus*, through which by the pressen of the Guts the Chyle is strained and received by the mouths of these vessels. From whence they proceed the readiest way to such Glandules of the Mesentery as are nearest to them: but in their passage many small ones uniting to one another do commonly grow into one large trunk; namely, a pretty way before they insinuate themselves into the Gland, to which we said they were going. But in their very entrance into the Gland, or a little before, this trunk

trunk separates again into new branches, more and smaller than the other. And thus far they are called *radicales*, or *primi generis*, of the first kind. Out of the Gland there spring again new capillary ones, which by and by meeting together make one trunk again as before, which keeping its course towards the centre of the Mesentery, enters as many Glands as lye in its way, being divided into new branches just before its entrance into each Gland, as before. But whilst all the trunks bend one way, they also meeting with one another, do in process several of them grow into one. And at length all the trunks arrive at the great or middle Gland of the Mesentery (called improperly *Pancreas*) which most of them enter into, but some of them pass over its Surface, and by and by they all empty themselves into the great or common receptacle of the Chyle that lies behind the said Gland, those that were inserted into it rising out of it in like manner as they did before out of the lesser Glands. As they run from one Gland to another, they are called *secundi generis*, or of the second kind: And from their having past all the Glands to their opening into the common receptacle, &c. they are called *tertii generis*, or of the third kind.

By the way we cannot omit to take notice of Glandulæ those three Glands which Bartholin calls *Lumbalumbares*, from their being situated upon the *Loins*, and which he thus describes. * Two of them which are larger, lye one upon the other betwixt the descending *Cava* and *Aorta*, in that Angle which the Emulgents make with the *Cava*. The third being smaller stands over these, under the appendices of the Diaphragm. They have communication, or are knit one to another by small lacteal

* *Anat. p.*
108.
Edir. 74.

lacteal branches, especially the two larger.] He once thought them to supply the place of the common Receptacle in Man; that not being so plain in him as in several Brutes. But since a Receptacle is acknowledg'd as well in Men as Brutes, Dr. Wharton's Opinion concerning their use seems more probable, viz. That they supply the place of those larger Glands that are found in the Mesenteries of Brutes, but are not natural to Men; And for this reason he presumes, that all such Animals as want those greater Glands in the Mesentery, have these *Lumbares* as well as Men.

Recepta-
culum
commun.

The common Receptacle is called *Receptaculum Chyli Pecquetianum*, from Pecquet who first found out both it and the *ductus Thoracicus* (whose beginning it is) in the year 1651. I mean he was the first that assigned the true use unto them, but both were observed in Horses by Bartholomæus Eustachius above an hundred and thirty years ago, as appears in a Book he writ, 1564. pag. 301. of the *Vena sine pari*, wherein he has these words, (as cited by Dr. Wharton.) From this notable left trunk of the throat, (viz. the Subclavian Vein) there springs a great branch, which besides that it has a semicircular door, (or valve) in its Origine, is moreover white, and full of a watry humour; and not far from its rise it is divided into two, that after a little space unite again into one, which sending forth no branches descends by the left side of the vertebræ, and having past through the Midriff runs down to the middle of the Loins: where becoming larger, and folding about the great Artery, it has an obscure ending, which I have not as yet well discover'd.] Here we have a clear description of them, only that is the beginning

beginning which he takes for the end ; and contrarily. It is called the *common* Receptacle , because it receives both the Chyle and Lympha promiscuously ; though some call it the Receptacle of *the Chyle* in particular : but without reason ; for it might as well be called *Receptaculum Lymphæ*, as *Chyli*, for that the *Lympha* passes not only with the Chyle , but after this is all distributed , the *Lympha* still continues to glide into it and to ascend by the *ductus chyliiferus Thoracicus*, which might as well be called *Lymphaticus* for the same reason.

It is seated under the Celiac Artery and E- ^{Its size, and} mulgent Veins , about the middle distance be- ^{substance.} tween the Kidneys and *capsulæ atrabiliaræ* , upon the *vertebræ* of the Loins , but for the most part rather toward the left side. *Pecquet* and *Casp. Bartholin* say , 'tis seated betwixt the tendons (or *appendices*) of the Diaphragm ; by the motion whereof it is pressed and milked , as it were, and its contents propelled. It is of a membranous , but thicker *substance* in Men than in Brutes , but not so capacious , seldom being so large as to admit ones Finger's end. Out of it there springs a duct that presently ascends up into the *Thorax* (behind the descending trunk of the *Arteria magna*) where it begins to be called *ductus Thoracicus* , but , according to *Sylvius* , it might more fitly be called *Spinalis*, seeing it runs along the inside of the *Spina dorsæ*. And now though it be past out of the *Abdomen* (of the contents whereof we are here treating) yet we will trace it through the middle Ventricle to the Heart whither it conveys its liquor , for the same reason that being above to speak of the Stomach, we thought it best to describe the Gullet
also,

also, which is an appendage to it, and by which the Meat descends into it.

*Ductus
chyliiferus
thoraci-
cus.*

This *Duct* then having past the Midriff, marches further upward under the great Artery till about the fifth or sixth *vertebra* of the *Thorax*, where it turns a little aside from under it to the left hand; and so underneath the intercostal Arteries and Veins, and the Gland *Thymus*, it ascends to the left subclavian Vein, into whose lower side it opens, just there where the left jugular Vein enters into it on the upper side, so that their Mouths face one another. But it opens not into this Vein with any large orifice, but by six or seven little ones, which are all cover'd in the Cavity of the *Subclavia* with one broad Valve, looking towards the *Cava* from the Shoulder, whereby there is granted to the Chyle and *Lympha* a free passage out of the *ductus Chyliiferus* into the *Subclavia*, but their return (or of Blood with them) out of the Vein into the *Duct* is prevented. This *Duct* ending thus in the Subclavian vein, the Chyle that it conveys into it passes with the Blood (returning by the *Cava*) into the right ventricle of the Heart, where we will leave it, and return to the *Vena lactea* again; having only observed, that this *Duct* has many semilunar Valves that hinder the ascending Chyle and *Lympha* from gliding back again; which Valves are manifest by this, that the Chyle contained in the *Duct* may easily by the Finger be pressed upwards, but by no means downwards: or if one make a hole in it, the liquor tending from beneath upwards will flow out at it; but that which is above it, is so stop't by the *Valves*, that it cannot be made to descend by it.

The

The *Venæ lacteæ* differ from the ordinary Mesaraick veins : *The difference between the Venæ lacteæ, and the ordinary mesaraick Veins.*

First, in *bigness*; for the Mesaraicks are bigger, but the *Lacteæ* are far more in number. Which was necessary, in that more Chyle must pass by them the way that has been spoken, to make Blood of, for the nourishment of the whole Body, than there can be Blood remaining from the nourishment of the Intestines only, to return by the Mesaraicks to the Liver.

Secondly, they differ in *colour*, by reason of the great difference in colour of the liquors they contain. The Lacteals are white and limpid, by reason of the whiteness and clearness of the Chyle that is conveyed by them; but the Mesaraicks are of a dusky blackish colour.

Thirdly, they differ in their *insertion*; for the Lacteals, as has been said, are inserted into the great Gland of the Mesentery, from whence they run forwards to the common receptacle, but the Mesaraicks all terminate in the Liver.

But though there be this plain difference between these two, yet there is not the like betwixt the *Venæ lacteæ* and the *Lympheducts*; for many good Anatomists do affirm, that before and after the distribution of the Chyle, not only the Receptacle and *ductus thoracicus* contain *Lymphæ*, but that they have seen even the *Venæ lacteæ* themselves do so too, and question whether the same vessels be not, in the Mesentery, common Conduits for both liquors. I believe that the *Lacteæ radicales* (or *primi generis*) are truly distinct from the Lympheducts, but hesitate as to those *secundi*, & *tertii generis*. *whether they differ from the ductus Lymphatici.*

They have a pretty many *Valves*, but not so many as the *ductus Thoracicus*. They may be discovered the same way as we intimated those of the *Their Valves.*

the *Ductus* might, *viz.* that if they be pressed towards the great Gland, they are presently emptied; but if one press them from the Gland towards the Intestines, the Chyle will stop, and cannot be driven thither.

*The reason
of the mo-
tion of the
Chyle.*

By what has been said, it sufficiently appears, what way the Chyle passes from the Guts to the Heart; but there is another thing to be enquired into, *viz.* what should be the reason or cause of this motion. This we cannot impute to the attraction of the *Lactea*, as if they suck'd up the Chyle out of the Guts, for such elective attraction has been a long time exploded: but the true reason is, the pressure of the Guts, whereby the Chyle is squeezed through their spongy inner Crust or Coat into the Mouths of the *Lactea*. Which pressure proceeds partly from that undulating contraction of the Guts that is performed by their own Fibres, which one may plainly observe in Cones, &c. opened alive; and partly from their being heaved to and again by the Muscles of the *Abdomen*, and the *Diaphragm* in respiration. Now as soon as the Chyle is once got into the *Lactea*, we need not be solicitous for a reason of its further progress to the Receptacle and up the Thoracick Duct; for what is once got in, cannot slide back again, by reason of the Valves; and seeing so long as there is any Chyle in the Guts, there is no cessation of its being prest into the *Lactea*, that which comes behind must needs drive forward that which went before, by which it is made to ascend to the Heart. Which ascent is also helped by the *Lympha* that mixes with it in the Receptacle and Duct, not only in that it is thereby dilated, but more especially from that motion which is impressed upon the *Lympha* from the pulsation of the

the Heart, whereby it is made to circulate by the Lympheducts, as well as the Blood by the Veins.

CHAP. XI.

Of the Liver.

THE Liver is seated in the upper part of the *Abdomen*, namely about a finger's breadth distance from under the Midriff, in the right Hypochondre, (under the short Ribs) which, being of a great bulk, it quite fills in a manner, and reaches from thence towards the left side, a little beyond the *Cartilago ensiformis*, or pit of the Stomach. Its upper side is convex or round and smooth, the under is hollow, lying on the right side of the Stomach and *pylorus*, &c. Its lower edge reaches below the short Ribs on the right side, and very near as low as the Navel before.

In Dogs and many other Brutes, it is plainly divided into divers Lobes; to which that Man's might seem to correspond, many of the Ancients reckon'd it to have four Lobes, called *porta*, *mensa*, *gladius* and *unguis*; and Galen describes five: But Columbus and Glisson do more truly affirm it to be undivided, or continuous: onely there is a little protuberance in its hollow side, to which the Caul is knit, which Spigelius called a Lobe, and from him others; but it is improperly called so, and is not at all like the Lobes in the Livers of Brutes.

It has three Ligaments (properly so called) which according to Dr. Glisson (*de Hepate*) are these. The first is called *Suspensorium*, because it suspends the Liver, or ties it up to the Diaphragm;

phragm ; it is broad , membranous and strong, arising from the *Peritonæum* , and is not onely fixed to the outer membrane of the Liver , but does indeed make it , and descends even into the Liver, and is strongly fastened to the common sheath or *involucrum* of the *Vena cava* (there where the umbilical Vein is continuous to it.) By this strong insertion it is the more able to bear up the great weight of the Liver.

The second is the *Vena umbilicalis*, which after the birth, closes up and hardens into a Ligament. It is directly opposite to the former. It passes out of the hollow side of the Liver by the *Porta*, and terminates in the Navel. By this the Liver is kept from ascending upon the motion of the Diaphragm upwards in respiration.

The third is that whereby the Liver adheres to the *Cartilago ensiformis*. This is thin and flaccid, but yet strong, broad and doubled , arising from that Membrane wherewith the Liver is encompassed, (according to *Spigelius*) of which it is a duplicature (according to Dr. *Glisson*.) This hinders it from fluctuating to one or t'other side, or towards the Back.

Besides these three Ligaments , it has several other connexions to the neighbouring parts , by the Vessels that come into it, or go out of it ; but those would improperly be called Ligaments.

Membrane. It is covered with a very thin *Membrane* that springeth from the first Ligament (as was said before) which cleaveth firmly to the substance of the Liver. It is sometime separated from it by a watrish humour , issuing out of the capillary Veins, or Lymphaticks, whereby watrish Pustules, by the Grecians called *Ascites*, are ingendred. If these break , the water falleth into the cavity of the Belly , and in part at least causeth that kind of Dropsie called *Ascites*. Its

Its *Substance* (besides the vessels) has used by *Substance*.
 most Anatomists to be called *parenchyma*, as if it
 were nothing but an *Affusion* of some certain hu-
 mour about the vessels, and there concreted. And
 because it looks red, they have esteemed it to be
 blood. But red is not its proper colour, as Dr.
Glisson thinks; nor is it parenchymatous, as *Mal-*
pighius teaches. For the former says, That its
 redness is only borrowed from the great quanti-
 ty of blood that is transcolated through it out of
 the *Porta* into the *Cava*, its proper colour being
 pale, a little yellowish, such as the Liver is of
 when 'tis boil'd; and yet that yellowishness seems
 to be caused by the Bile which is separated in it:
 And the latter esteems it to be glandulous, and
 naturally of a white colour; whose observations
 by the Microscope, being curious, I shall express
 in short, as they are contained in his *lib. de Hepat.*
capp. 2, 3, 5. "He says, That 1. the *Parenchyma*
 "(so called) of the Liver in Man is framed of
 "innumerable Lobules, which have commonly
 "each of them six sides like a Die, and consist
 "of several little six-corner'd Glands like the
 "stones of Grapes, (so that the Lobules look
 "like bunches of Grapes) and are each cloathed
 "with a proper circumambient Membrane, and
 "are joyned to one another by Membranes con-
 "tinued from the circumambient, and running
 "transversely; yet so, as that certain *rimulae* or
 "little chinks result from the joyning of the sides
 "of the Lobules together. 2. That the whole
 "bulk of the Liver consists of these little Grape-
 "stone-like Glands, and of divers sorts of Vessels;
 "and hence, that they may perform together a
 "common work, Reason concludes it necessary,
 "that there be a commerce betwixt these Glands
 "and Vessels, though Sense cannot discern the
 G "very

"very slender extream twigs of the Vessels that
 "are inserted into the Glands. 3. That the
 "little branches of the *Porta*, *Cava*, and *Porus*
 "*bilarius*, do run through all even the least Lo-
 "bules in an equal number: that the *Porta* does
 "the office of an Artery, and has so great so-
 "ciet^y with the *Porus bilarius*, that both their
 "twigs are straitly tyed together in the same
 "cover. 4. That the shoots of the said Vessels
 "are not joyned by Anastomoses, but that the
 "Grape-stone-like Glandules, making the chief
 "substance of the Liver, are a *medium* between
 "the importing and exporting Vessels, so that
 "by the interposition of these, the Importers
 "transfuse their liquor into the Exporters. From
 "these Observations he concludes the Liver to
 "be a *conglomerate Gland*, separating the Bile.—
 "And because it is usual for the conglomerate
 "Glands to have, besides Arteries, Veins, and
 "Nerves, a proper excretory Vessel (as in the
 "*Pancreas*, *Parotides*, &c.) dispersed through
 "their substance, receiving and carrying away the
 "humour separated in them, this kind of Vessel
 "in the Liver is the *Porus bilarius* with the Gall-
 "bladder.] Which account of the *parenchyma*, &c.
 of the Liver, though new, and far differing from
 any heretofore delivered by others, is now recei-
 ved generally among Anatomists. And whereas
 several Lymphatick vessels are said to arise from
 the Liver, and therefore it may seem to have a
 double excretory vessel; he thinks, that seeing
 in other places the Lympheducts use to arise
 not from conglomerate but conglobate Glands,
 therefore they do not truly spring from the Li-
 ver it self, but from those conspicuous conglo-
 bate Glands that are in the hollow of the Liver
 under the *involucrum* or *capsula*, where the trunks
 of

of the *Porta* and *porus bilarius* enter into it. Even as *Steno* observes, that the Lympheducts which seem to spring from the *Parotides*, do not indeed spring from them, but from a conglobate Gland that is contiguous to them.

It hath two sorts of *Veins*. In its upper part *Veins*. the *Vena cava* entrencheth into it, and spreads it self all through it in the lower as well as upper part. Into the lower side the *Vena portæ* is inserted, whose branches likewise run through its whole *Parenchyma*. Of both these Veins more fully in the two following Chapters.

It has but very small and few *Arteries*, for the *Arteries*. *Porta* serves it for an Artery, bringing blood to it. Those which it has, do all arise from the right branch of the *Arteria cæliaca*, (called *Hepaticus*) which being sustained by the Coats of the Caul, ascends to the hollow of the Liver just by the *Vena portæ*, on whose Coat, with the Biliary vessels, and the Membrane of the Liver, it is wholly spent. For, as was said, the *Parenchyma* (so called) is nourished by the blood brought by the *Porta*.

It has *Nerves* from the Intercoastal pair, namely one from the stomachical branch thereof, another from the mesenterical (called *Hepaticus*.) But the Nerves are extended only to the Membrane and vessels of the Liver, (as the Arteries were) so that the *Parenchyma* has but a very dull sense.

Till the *ductus Thoracicus Chyliferus* was found *Lymphæ* out, it was still believed that the *Vena lactea ducta*. were inserted into the Liver, which was looked upon as the great Organ of Sanguification; but now 'tis known for certain that no *Lactæ* at all go to the Liver, but that those vessels which were taken for such, are *Lymphatick* vessels carrying

rying from it a most limpid and pellucid juice. That they are dispersed in the *Parenchyma* of the Liver, has not yet been observed; nay, as was noted before, *Malpighius* believes they are not derived from the Liver at all, but from those conglobate Glands that lye under the *Porta* at its ingress into the Liver, and sometimes adhere to it, from whence taking their course chiefly along the Mesentery, they open themselves into the *Receptaculum Chyli*. But supposing that they enter'd the substance of the Liver, lest any one should suspect them to be Lacteals, for which they were a good while taken, after the Lacteals of the Mesentery were found out, but the common Receptacle and thoracick Duct were not as yet known; I say, lest any should suspect them to be Lacteals, and so to import Chyle to the Liver, let him satisfy himself with this Experiment, *viz.* let him in vivisection make a ligature about any one of them or more, and he will see them presently swell betwixt the Ligature and the Liver, but be empty on that side towards the Receptacle. And the same will be more evident if he examine their *Valves* also, which open towards the said Receptacle, but hinder any thing from coming back from thence to the Liver.

The Biliary
I Jals.

Concerning the *Biliary Vessels* we shall forbear to speak here, designing a particular Chapter for them, *viz.* ch. 14.

The Liver
does not
scurge.

Hippocrates in lib. 4. de *Morb.* says, *The fountain of blood is the Heart, the place of Choler is in the Liver*, which comes very near the truth, as shall appear hereafter. But after him both the *Greeks* and *Arabs* generally held, that the Mesaraick veins received the Chyle from the Guts, and brought it to the Liver, by which it was turned into Blood,
which

which was carried from it into all the parts of the Body by the Veins. Yea and even since the *Vena lactea* were found out, Anatomists believed that they all terminated in it, because they judged it the fittest Bowel for Sanguification, presuming that that task must be performed by some or other. But not to multiply Arguments for the confutation of so generally rejected an Opinion, this one may be sufficient to evince its falsity, That none of the *Vena lactea* are inserted into the Liver, and consequently no Chyle is imported into it, whereof Blood should be made. (How and where Sanguification is performed, we shall shew when we come to the Heart.)

The Liver then being discharged from Sanguification, its true action is to separate the *Bile* from the Blood, which is brought plentifully to it by the *Vena porta*. As to the manner of its separation, some say it is meerly by colature, others think a Fermentation also necessary: but this is too intricate a Controversie to enter upon here, and therefore waving it, I shall pass on to speak of the nature and use of the *Bile*. *Its true action.*

The Ancients (amongst whom was *Aristotle*) thought it to be a meer Excrement, and to be of no other use than by its Acrimony to promote the excretion of the Guts. And this Opinion prevail'd so long as it was believ'd that the Liver had a nobler action than meerly to separate the Choler. But now it being found out that it has no other Office, it seems unlikely that so bulky a Bowel was made only for the separation of a meer Excrement, and therefore 'tis believed to be a Ferment for the Chyle and Blood. This new Doctrine I shall give entirely out of *De-meubroeck*, p. 154. "The Blood flowing into the Liver by the *Porta* out of the Gastrick and Mo- *The nature and use of the Bile.*

“saraick veins (and it may be a little by the
“Hepatick Artery) is mixed with an acrimo-
“nious, saltish, and subacid juice, (made in
“the Spleen, of the arterious Blood flowing thi-
“ther by the Arteries, and of the animal Spi-
“rits by the Nerves) which is brought into the
“*Porta* by the *Ramus Splenicus*. Now both these
“being entred the Liver by the branches of the
“*Porta*, by means of this said acrimonious and
“acid juice, and the specifick virtue or cocti-
“on of the Liver, the spirituous particles, both
“sulphureous and salt, lying hid in the said ve-
“nous Blood, are dissolved, attenuated, and
“become also a little acrimonious and ferment-
“ing; a certain thinnest part whereof, like
“most clear water, being separated from the
“other thicker mass of the Blood by means of
“the conglobated Glands, plac’d mostly in the
“hollow side of the Liver, is carried from
“thence by many Lympheducts, as has been
“said. But the fermentaceous Spirits of greater
“Acrimony, mixed with the thicker and more
“viscid sulphureous Juices, (for Sulphur is vi-
“scid) and more strongly boiling, whenas thro’
“the clamminess of the Juices in which they in-
“here, they cannot enter the conglobated
“Glands, nor from them the Lympheducts, and
“yet through their fierce ebullition are separa-
“ted from the Blood (as Yest from Beer) these
“fermentaceous Spirits, I say, being sever’d with
“the Juice in which they inhere, become bitter,
“and are called *Bile*. Which *Bile* being transco-
“lated through the Grape-stone-like Glandules
“into the roots of the *Porus Hilarius*, and of the
“Gall-bladder, passes through them by the
“*Ductus communis* into the *Duodenum* or *Jeju-
“num*, where it is presently mixed with the
“Pancreatick

"Pancreatick juice, and both of them with the
"alimentary mass, concocted in the Stomach, and
"now passing down this way, which it causes
"to ferment. And because at its first entrance
"it is more acrimonious, and has its vertue en-
"tire, and so causes the greatest ebullition with
"the Pancreatick juice, hence the milky Juice
"contained in the mass concocted in the Sto-
"mach, is most readily and in greatest quantity
"separated in the *Jejunum*, and by innumerable
"Lacteal vessels, (which are more numerous in
"this than the other Guts) it is most quickly
"driven on towards the *Receptaculum Chyli*, and
"this is the reason that this Gut is always so
"empty. But in the following Guts because the
"Fermentaceous Spirits are a little pass'd, the
"effervescency becomes slower and less efficaci-
"ous, and the Chyle is more slowly separated
"from the thicker mass, and therefore they
"have fewer *Vene lactee*. At length what re-
"mains of this fermenting matter is mixed with
"the thick *feces* in the thick Guts, where by its
"Acrimony it irritates them to excretion.]
Thus far that perspicacious and judicious Ana-
tomist. And indeed if the Liver have no other
office but to separate the Choler, it is by no
means to be reputed an Excrement: for though
the Liver do not sanguifie, yet however it is to
be esteemed as a very noble part, seeing the Dis-
eases thereof are generally so dangerous, and
wounds in it are so commonly mortal; and by
consequence that liquor which it separates must
have some noble use, and such as is very neces-
sary unto life.

C H A P- XII.

Of the Vena Portæ.

Vena
Portæ.

THough it be the method of Anatomists usually to deliver the Doctrine of all the Veins in a distinct Chapter or Book after the description of the three Ventricles; yet seeing all the Veins seem (and by the *Galenists* have been affirmed) to have their root in the Liver, of which therefore we cannot but take notice; on this account we will here describe their branchings within the *Abdomen*, seeing they are parts contained in it. Only in contradiction of *Galen's* Opinion we desire it may be noted, that their root is more properly said to be in those parts wherein they receive their blood from the Arteries, than in the Liver (or in the Heart) whither they convey it. Now we shall in the first place describe the branchings of the *Vena Portæ*.

Its Name. It hath this name from the two Eminences (called by *Hippocrates* πύλαι, *Portæ*, Gates) betwixt which it enters into the lower side of the Liver; and sometimes, without the general name of *Vena*, it is called only *Porta*.

Origin. Some think that the *Vena umbilicalis* ought to be accounted its Root or Original, because it is first formed in the *Fœtus* and inserted into the *Porta*. But this Umbilical vein after the Birth ceasing from the office of a Vein, and degenerating into a Ligament, though it might be accounted its root then, it cannot properly now. Others think, that because its branches every where inserted into the Intestines bring blood from thence to the Liver, (and not *vice versa*) therefore

therefore those ought rather to be accounted its roots, and its divisions within the Liver its branches. And indeed strictly and properly they ought to be accounted so, but however we shall not think it absurd to speak with the Ancients, who because they thought the *Porta* carried blood from the Liver to the Guts for their nourishment, suppos'd it to spring out of the Liver.

As it enters into the Liver, it is invested with another Coat, which some call *Vagina portæ*, its Sheath, others *Capsula* or *involucrum*, its Case, or Cover, and *Capsula communis*, because the *Porus bilivius* is involved in it as well as the *Porta*. This outer Coat it has immediately from the membrane that cloaths the Liver, that is, it is continued from it, though it be of a clear other substance, namely more dense and carnous. It is invested with it in all its ramifications, and so having a double Coat is in that respect an Artery, as also in that it brings blood to the Liver for its nourishment as well as for other uses, and lastly, in that by means of the *Arteria hepatica* inserted into the *Capsula* it has an obscure pulsation (according to Doctor *Glisson*.)

When it is enter'd about half an inch into the Liver, it is carried partly to the right hand, partly to the left, and so is shap'd into a *Sinus* as it were, and thence is divided into five large branches, four whereof are diffus'd all over the hollow side of the Liver, but the fifth ascends straight to its upper side where it disperses it self. The said *Sinus* is more conspicuous in an *Embryo*, because the great influx of nutritious juice by the Umbilical Veins enlarges it much. Some make it a sort of Heart, observing in it an obscurer kind of *Systole* and *Diastole*, whereby the motion of the

the blood in the branches of the *Porta* within the Liver, is promoted in like manner as it is in the *Arteria pulmonaris* and *Aorta* by the right and left Ventracles of the heart. Without which pulsation they think the blood would hardly pass out of the larger branches of the *Porta* into the narrower, and so on into the roots of the *Cava*. In an *Embryo* very observable is the *Tubulus* or *Canalis venosus*, which passes directly out of this *Sinus* into the *Cava*, (almost opposite to the mouth of the Umbilical Vein that opens into the *Sinus*.) This *Canalis* or Pipe is of the same substance and texture with a Vein, and enters into the *Cava* just as it penetrates the Diaphragm; and there also two other great branches out of the Liver are inserted into the *Cava*; and in the same place this Pipe is also knit to the suspensory Ligament spoken of before, and after the Child is born grows it self into a Ligament, being in a manner opposite to the umbilical Ligament. Its Use in the *fœtus* is for the freer and readier motion of the blood and chyle out of the umbilical Vein into the *Cava*, seeing the current is hardly strong enough to pervade the *Parenchyma* of the Liver; nor indeed is there any reason why the said liquors should pass there-through, seeing there is either little or no Bile therein, or however they are not yet in a condition to have the same separated from them. But to return to the divisions of the *Porta*. The Ancients taught that they were only spread in the simous or hollow part of the Liver, but Dr. *Glisson* in his accurate Anatomy of it, affirms the *Porta* to be dispersed very equally in all its parts, upper as well as lower. And whereas it has been a constant doctrine, that the branches of the *Porta* open by *anastomoses* into those of the *Cava*, the same learned Author,
and

and many others since him, have observed, that there are no such *anastomoses* at all, but that the blood doth ouze through the glandulous *Parenchyma* of the Liver out of the Capillary veins of the *Porta* into those of the *Cava*. He that would be fullier informed hereof, may consult his most accurate Book *de Hepate*. But we will now pass to the branches of the *Porta* when it is gone out of the Liver.

This Trunk having past a little from the Liver, before it be severed into branches, puts forth two twigs, out of its upper and fore-part, which are inserted into the *Cystis fellea* or Gall-bladder (and are from thence called *Cystica gemella*) about the neck of it, and spread by innumerable twigs through its external coat.

*Its branches
without the
Liver.*

A third twig also arises single from it, which is larger than either of the former, and is inserted into the bottom of the right side of the Stomach, from whence it ascends by its hinder side up to the *Pylorus*, which gives it the name of *Pylorica*; it is otherwise called *Gastrica dextra*.

Having sent forth these three twigs, the Trunk passeth down, and bending a little towards the left side, it is parted into two remarkable branches; whereof the upper is called *sinister*, or the *left*, and is the lesser: the lower *dexter* or the *right*, which is the larger. The *left* is bestowed upon the Stomach, the *Omentum*, a part of *Colon*, and the Spleen; the *right* is spread through the Guts and Mesentery: the *left* is called *Vena splenica*; but the *right Vena mesenterica*.

The *Vena splenica* runs across the body towards the left side, being sustained by the hinder leaf of the Caul, and hath two branches issuing out of it before it come to the Spleen, viz. the *superiour* and the *inferiour*.

Vena splenica.

The

The *superiour* is called *Gastrica*, or *Ventricularis*, because it is bestowed upon the Stomach. It ascends obliquely towards the left part of the Stomach, into the back side whereof it is inserted, and divides it self into three sprigs, of which the two outmost are spent on the body of the Stomach, but the middle ascends on its back-side up to its upper or left orifice, which it encompasses like a Garland, and is called *Coronaria*. From the *inferiour* branch two twigs spring; The one is small, and sends twigs to the right side of the inner leaf of the *Omentum*, and to the *Colon* annexed to it. This is called *Epiplöis* or *Omentalis dextra*. The other is spent upon the same leaf of the *Omentum*, with that part of the *Colon* which it ties to the Back, and is call *Epiplöis* or *Omentalis postica*.

When the *Ramus splenicus* hath just approached to the Spleen, it sends out two other twigs, the upper and lower. The *upper* is called *vas breve venosum*, and is implanted into the left part of the bottom of the Stomach. It is sometimes single, in which case it is properly called *vas breve* in the singular number; but more often there are two, three or more of them, and then they should be called *vasa brevia*. And note, that these Vessels, be they one or more, do sometimes spring from the *Ramus splenicus* after it has entered the Spleen.

This *vas breve* was a vessel much renowned by the Ancients, who believed it carried an acid juice from the Spleen to the Stomach to stir up appetite, and to help the fermentation of the meat in it; but it is certain both by Ligature (whereby it filleth toward the Stomach, and emptieth toward the Spleen) and also by the general nature of Veins, whose smaller branches and twigs

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still receive the superfluous Arterial blood from the part whereinto they are inserted, and conduct it by the larger chanel towards the Heart; I say it is certain from hence, that this same *vas breve* carries nothing to the Stomach, but onely brings from thence into the *Ramus splenicus* the remains of the arterial blood.

From the lower, two Twigs issue.

The first is called *Gastroëpiplois sinistra*; this is bestowed upon the left part of the bottom of the Stomach, and the fore-leaf of the *Omentum*, chiefly on its left part.

The second springeth most commonly indeed from *Ramus splenicus*, but sometimes from the left Mesenterick vein; and running along the *Intestinum Rectum*, is inserted into the *Anus*, by many twigs. This is called *Hæmorrhoidalis interna*, as that which springeth from the *Vena cava* is called *Hæmorrhoidalis externa*.

Now followeth *Vena mesenterica*, or the right Vena mesenterica branch of *Vena portæ*. Before it be divided into senterica branches, it sendeth forth two twigs.

The first is called *Gastroëpiplois dextra*; this is bestowed upon the right part of the bottom of the Stomach, and the right side of the upper leaf of the Caul.

The second is called *Intestinalis*, or *Duodena*: It is inserted into the middle of the *Duodenum*, and the beginning of the *Jejunum*, and runneth lengthways of them: whence some capillary twigs go to the *Pancreas* and the upper part of the *Omentum*.

After these twigs are past from it, it enters by one trunk into the Mesentery, where presently it is divided into two branches, to wit, *Mesenterica dextra*, & *sinistra*.

Mesenterica

Mesenterica dextra (placed on the right side) is double, and sendeth a great number of branches to the *Jejunum*, *Ileum*, *Cecum*, and the right part of the *Colon* which ascendeth up by the right Kidney and runs under the Liver.

It hath fourteen remarkable, though nameless branches; and these are afterwards divided into innumerable small twigs. These are those Veins that are called the *Mesaraicks*, whose branches are supported by the Glandules of the *Mesentery*, but enter not into them; for the Glands minister to the *vena lactea*.

Mesenterica sinistra passeth through the middle of the *Mesentery*, to that part of the *Colon* which descendeth from the left part of the Stomach, and to the *Intestinum Rectum*.

The Use of
the Porta.

The Use of the *Porta*, before the circulation of the blood, and the *Vena lactea* were found out, was taught to be for the carrying of nourishment to the Intestines and other parts contained in the *Abdomen*, and also to bring back from the Guts the purer part of the Chyle to the Liver to make Blood of, and a thicker feculent part of it to the Spleen, to be excocted by it into an acid juice, and then carried to the Stomach by the *vas breve venosum* for the exciting of hunger. As for this last opinion, it appears by Ligature, that the *vas breve* carries its contents from the Stomach to the *Ramus splenicus*, and it is nothing but the Blood remaining from the nutrition of the Stomach (that was brought thither by the Arteries) which is now a conveying back to the Liver and so to the Heart again in its circulation. And as for the *Mesaraicks* carrying nourishment to the Guts, or bringing back Chyle, those errors have been sufficiently laid open before in the Chapters of the *Vena lactea* and the Liver. And their true

Use

Use is only to bring back to the Liver from the Guts that Blood which remains after their nutrition, and which was carried to them by the mesaraick Arteries.

C H A P. XIII.

Of the Vena Cava dispersed within the Abdomen.

THE *Vena Cava* is so called from its large Vena cavity, being the most capacious of any va. Vein of the whole Body; for into it as into a *its name* River or common Chanel do all the other Veins like Rivulets (excepting the *Pulmonaria*) empty themselves.

Its Root may very properly be said to be in the *Rise*. Liver; for by its Capillaries it receives the Blood that is transcolated through the glandulous *parenchyma* of the Liver from the Capillaries of the *Porta*, and by its ascending trunk conveys it to the Heart. Now these roots may in some regard be commodiously enough also called branches; for the roots of a Tree in the Earth, as well as its boughs in the Air are spread into many branches: onely there is this difference, that roots bring sap to the trunk, but boughs carry it from the same. However we shall call them indifferently roots or branches. The capillary branches then of the *Cava* are spread through the whole substance of the Liver, and not its upper or gibbous part onely, as has formerly been taught; even as we said before that the Capillaries of the *Porta* were indifferently dispers'd all over it. Betwixt these Capillaries (much less betwixt their larger

larger branches) there are no inosculations or anastomoses, but those of the *Porta* being quite obliterated in the glands or glandulous *Parenchyma* of the Liver, these of the *Cava* arise out of the same, and whiles they pass towards the trunk of the *Cava*, many of them meeting together make a twig, as many twigs in like manner concurring make a branch, which still proceeding further, by the accession of new twigs and branches becomes larger and larger, and at length dischargeth it self into the *Cava*. And thus do all the roots of the *Cava* in the Liver. But they do not all meet together in one common trunk within the Liver, as those of the *Porta* do, but empty themselves apart into the *Cava* without the Liver. And still the further distance the Capillaries have their origine from the *Cava*, the larger their channel comes to be at their arrival at it. The smaller twigs are innumerable; the larger roots joyning immediately to the *Cava* are commonly but three, though two of them are presently (towards the Liver) divided into other two, as large each as themselves, so that one may account them to be five.

Division.

These emptying all the Blood exhausted out of the Liver into the *Cava*, it is presently divided into the Ascending and Descending trunk. The *Ascending* forthwith enters the Diaphragm and marches up the *Thorax*, where we shall leave it till we come thither, and onely here speak of the *Descending* trunk as long as it continues in the *Abdomen*.

Its descending trunk.

The *Descending* trunk is somewhat narrower than the *Ascending*, and passing down along with the great Artery it continues undivided till the fourth *vertebra* of the Loins. But in the mean time it sends forth divers branches from its trunk. As

1. The

1. The *Venæ adiposæ*, for the Coat and fat of the Kidneys ; whereof that on the left side goes out first.

2. The *Emulgents*, which run to the Kidneys by a short and oblique passage ; these bring back that blood to the *Cava* which the emulgent Arteries carried to the Kidneys with the *Serum*.

3. The *Spermaticks*, called *Vasa preparantia*. The right springeth from the trunk of *Vena Cava* a little below the *Emulgent* ; but the left from the left *Emulgent* it self. Of these more in the 20th Chapter.

4. The *Lumbares*, sometimes two, sometimes three. These run in between four *vertebra* of the Loins, and are dispersed through the membranes that cloath the spinal marrow.

All these Veins being sent forth of the trunk, by this time it is come to the fourth *vertebra* of the Loins, where it turns to behind the *Arteria magna*, above or before which it had thus far descended, and is divided into two equal branches, called *Iliaci*, because they pass over the *Os ilcon*, &c. as they go down to the Thighs.

Just about the division there spring two Veins called, *Muscula superior*, for the *Peritonæum* and Muscles of the Loins and *Abdomen* ; and *Sacra*, which is sometimes single, sometimes double, for the marrow of *Os sacrum*, or rather for the membranes that cloath it.

Afterwards the *Iliacal* branches are again divided each into two other, the Exterior that is greater, and the Interior that is less.

From the *interiour* arise two Veins. *Muscula media*, for the Muscles of the Hip and Buttocks ; and *Hypogastrica*, which is a notable one, sometimes double, ministring to most parts of the *Hypogastrium* ; as to the Muscles of the streight Gut,

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(which

(which branches make the external Hæmorrhoids;) to the Bladder and its neck, to the Yard, and the lower side of the Womb and its neck, which last are the Veins by which the Menstrues were believed to pass, before the circulation of the Blood was found out; for since 'tis known that they pass by the Hypogastrick Arteries, and what Blood is not sent forth at those times, or at other times is not spent on the nutrition of these parts, returns by these Veins to the Cava, and by it to the Heart.

From the *exteriour*, three: two before it goes out of the *Peritoneum*, and one after.

1. *Epigastrica*, for the *Peritoneum* and the Muscles of the *Abdomen*; the most noted branch of it ascends under the *Musculi recti* towards the *Vena mammaria*, with which it has been thought to inosculate about the Navel.

2. *Pudenda*, for the Genitals in Men and Women.

3. *Muscula inferior*, for the Buttocks.

And now the descending branches of the *Cava* are past out of the *Abdomen* into the Thighs, and begin to be called *Cural*; and of them we shall discourse when we come to the *Limbs*, in *Book IV. Chap. 4.*

Its Use.

Now the *Use* of this Descending trunk of the *Vena Cava* is not to carry any thing to any part from the Liver; but wheresoever its lesser twigs end into Capillaries, from thence is Blood received (being brought thither by the respective Arteries) and conveyed into the greater branches, and by them into the trunk of the *Cava*, by which it ascends to the right ventricle of the Heart, there to be anew inspirited, and from thence to be sent forth again by the Arteries, as shall be further explained when we come to the Heart.

For

For though the Descending trunk of the *Aorta* or great Artery pass down the *Abdomen* along with that of the *Cava*, and so is contained therein as well as it; yet because the Arteries have all of them their Origine from the Heart, we will forbear to speak of *them* till we come to the Anatomy of it, in the next Book.

C H A P. XIV.

Of the Gall-bladder and Porus bilarius.

FOR the receiving and evacuating of Bile there have been reckoned only two Vessels or passages, namely the *Gall-bladder*, and *Porus bilarius*. By this latter there flows a thicker but milder; by the former a thinner, more acrimonious and fermentative Choler, into the Intestines. But besides these there have lately been found out a third, which we shall describe by and by.

The *Gall-bladder*, called in Greek *κύστις γαλλή*, *The Gall-bladder*, in Latine *Vesica biliaria*, or *Folliculus felleus*, is a hollow Bag placed in the under or hollow side of the Liver, and in figure representeth a Pear.

It is about two inches in length, and one in breadth where broadest.

By its upper part it adheres to the Liver, which doth afford it a hollownes to lodge in; but the lower part which hangeth without the Liver, resteth upon the right side of the Stomach, and the Colon, and doth often dye them both yellow.

It hath three Membranes, one common, which is thin and outmost. This springing in the Membrane of the Liver, onely covereth that part which hangeth without the Liver. The two other Membranes are proper.

The middle is thick and strong, and hath three ranks of *Fibres*; the outermost are transverse, the middlemost oblique, and the innermost streight.

The inmost Coat is nervous, or tendinous as it were; and to the inside of this there adhereth a kind of glandulous coat. The Glands herein do separate from the Arteries a kind of mucous humour, which serves to defend the *Vesica* from being irritated by the acrimony of the Choler contained in it.

Parts.

It hath two *Parts*, the *Bottom* and the *Neck*.

The *Bottom* is its larger or wider part that contains the Choler, and is of the same colour with the bile that is in it; whence it commonly looks yellow, but sometimes greenish, blackish, &c.

The *Neck* (otherwise called *meatus cysticus*) is its narrower part, being but about as wide as a Goose-quill, and about two inches long. Betwixt this and the *Vesica* there is a certain fibrous Ring which much straitens the passage, and so hinders the too hasty depletion of the *Vesica*. The other end of the Neck is joined to the *Porus bilarius*, and they both make the *Ductus communis*, or common passage of the Choler, which is inserted into the beginning of the *Jejunum*, or the end of the *Duodenum*. *Peierus* has observed that in many Birds and some Fishes this *Meatus* does not join the *Porus bilarius*, but is inserted separately into the Guts.

How the Choler is brought in to it.

* De secret. Animal. Cap.

14.

The Ancients (whose opinion is of late stiffly defended by Dr. * *Cole*) thought that the Choler in the Gall-bladder was received in by its neck from the *Porus bilarius*, and that it passed out into the common Duct the same way. And to obviate the Objection, that there uses not to be a reciprocation

cation of humours in the same Vessel, (at the same time especially) Dr. Cole supposes that the Gall passes out of the Gall-bladder onely in the time of the distribution of the Chyle, but at all other times it is received into it from the *Porus*, and is stored up in it against the next occasion. But not to enter into this dispute, I think Dr. Anat. He-
Glisson's account of it the more probable, which pat.
 is this: "The ordinary way of filling the Gall-bladder, is by its fibrous roots that are dispersed through the Liver. The whole trunk of these roots enters that part of the Bladder where 'tis straitned by a fibrous Ring. This trunk indeed hardly equals the hundredth part of the roots of the *Porus bilaris*; yet it dis-tributes some twigs and capillary Vessels into the hollow side of the Liver. But if you open the Gall-bladder with a design to understand the manner of the insertion of this trunk into it, truly you will not easily find it. For though this duct do penetrate the said Bladder, and the humour contain'd in it be discharged thereinto; yet there is hardly any print or sign of this hole in the inside of the Bladder; which ought not to seem hard to be believed by any one, if he remember the insertion of the Ureters into the Piss-bladder: for though these do far exceed this trunk in width, yet one can hardly find their insertion if he cut open the Bladder and look for it. The best way (that I could yet find) to discover the insertion of this trunk, (if you will open the Gall-bladder, and search for its entrance into it) is thus: namely, if you look for a certain little and spongy protuberance near the orifice of the Bladder hard by the *meatus cysticus*; for the foresaid trunk, I think, is pretty plainly

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"inserted

“inserted into that protuberance.] This protuberance is called a Valve by *Spigelius*.

Ductus
cyst-hepa-
ticus.

Besides this, Mr. *Perrault* has found out another new Conduit for the Bile, which he calls *ductus cyst-hepaticus*, because it is common both to the *Vesicula* and the *Porus hepaticus* (or *bilarius*.) This Duct has three roots, which being subdivided into numerous twigs are dispersed through the Parenchyma of the Liver amongst the branches of the *Vena cava* and *Portæ*: These roots grow into one trunk, which creeping along the surface of the hollow side of the Liver, has a double implantation, one into the *Porus bilarius* two inches and an half before the said *Porus*’s uniting with the *Asteatus cysticus*, and another into the middle of the *Vesica* (on that side of it which adheres to the Liver) with a Valve. This Valve seems to be formed of the inner Membrane of the *Vesica*, and also a proper one; and may be said to be a kind of a middle Valve between the nature of the *Sigmoides* and *Triglotis*, (or *Tricuspsis*) of the *Vena arteriosa* and *Arteria venosa* in the Heart. Betwixt its insertion into the *Porus bilarius*, and this into the *Vesica*, there is about six inches length. It contains a thinner Choler in it, than the *Porus bilarius*.

Of the cir-
culation of
the bile.

Jo. Alb. Borelus (Professor of the Mathematics at *Naples*) from the continual and speedy efflux of the bile by the *Ductus communis* into the *Duodenum*, believes that there is a particular circulation of it. For he affirms, That in a days time, from a person fasting, there passeth forty four pound of bilious juice into the *Duodenum* by the common *Duct*, whereas the whole mass of Gall amounts not to above two pound; from whence as he concludes, that so great a quantity of Gall cannot be produced in the Liver by way of fermentation,

mentation, but that it is separated mechanically, without the help of any ferment, only by *Cribration* from the minute vessels of the *Porta* through the Pores of the Glandules of the Liver, as the Urine is separated in the Kidneys; so he infers that there is a particular circulation of the *Bilis* through the *Abdomen*, perform'd by the *Venæ mesaraicæ* into the Trunk of the *Porta*, thence to the Liver, thence through the Bilious vessels into the *Duodenum*, to return again by the *Mesaraick* veins. He that would enquire more into this novel, and (to me) improbable Opinion, may consult his *Opus posthumum* (pars altera) *de motu Animalium*.

It has been taught by several Anatomists, that its Neck or *Meatus* has sometimes two, some-^{The Valves of the} times three *Valves* to hinder the recourse of the *Gall-bladder*. Choler: but *Diemerbræck* professes he could never find any, but only that the egress of the *Vesica* was very strait, and its Neck wrinkled. Dr. *Glisson* declares also that he has opened very many Vessels of this kind, and never yet saw a *Valve* in any of them. But he thinks that the fibrous ring (above mention'd) did impose upon those who have thought there was a *Valve*. Besides, upon tryal he has often found, that the Bile by a light compression of the Fingers, has fluctuated to and again out of the *Cystis* into the *Meatus*, and on the contrary; as also out of the *Meatus* into the *Ductus communis*, and back again. Which certainly could not be, if there were any *valves* in the way; for that would hinder the one or other of these motions.

The *Vesica fellea* hath two *Veins* called *Cysticæ* *gemellæ*, which spring from the *Porta*. It hath twigs of *Arteries* proceeding from the right branch of the *Calicea*. And it hath a small thread-

thread-like sprig of a *Nerve* from the Mesenterical branch of the Intercostal.

Of the stones in it. Many times *Stones* are found in it, which are lighter and more spongy than those of the urinary Bladder, and will swim above water, which these latter will not do.

Porus bilarius. The other passage which carrieth the thicker sort of *Choler*, is called *Porus bilarius*, or *Meatus hepaticus*, because it passeth directly from the Liver to the *Ductus communis*.

Its Coats, and branches within the Liver. Within the Liver its Trunk and Branches are invested with a double Coat: its proper one, which it retains without the Liver also, and another that is common to it with the *Porta* called *Capsula communis*, which it has from the Membrane of the Liver. In this common Coat this *Porus* and the *Porta* are so closely enwrapped, that you would take them but for one Vessel, till you either hold it up to the light, (which will discover Vessels of two colours in it) or very dextrously rip up the *Capsula*, and so lay them open. Its roots within the Liver are equally divided with those of the *Porta* every where, saving that little space where the roots of the *Vesica* are spread, in the lower and right side of the Liver. So that having spoken above of the divisions of the roots of the *Porta*, I shall refer the Reader thither for these of the *Porus*. I shall only observe, that they are far larger and more numerous than those of the *Vesica*, drawing *Choler* from all the parts of the Liver, (saving whither the roots of the Bladder reach) and that more thick and viscous, yet less acrimonious.

All Animals have it.

This *Porus* seems to be a more necessary part than the *Vesica*: for many Creatures, as Harts, Fallow-Deer, the Sea-Calf, &c. and those which have a whole Hoof, as an Horse, &c. have no Gall-

Gall-bladder, but there is none that is destitute of this.

Without the Liver it is as wide again as the *Meatus cysticus*, with which it is joyned at two Inches distance from the Liver, and both make the *Ductus communis choledochus*. Its connexion with the Meatus.

It has no *Valve* in its whole progress; only the *Ductus communis*, where it enters the Intestin, It hath no Valve, having pierced the outer Coat, passes betwixt that and the middlemost about the twelfth part of an Inch, and then piercing that also marches down further betwixt it and the innermost Coat about half an Inch, and at last opens with a round mouth into the Intestin. So that this oblique Insertion (as that of the Ureter into the urinary Bladder) serves instead of a *Valve* to hinder any thing from regurgitating out of the Gut into this Duct, especially the inmost Tunicle of the Intestin hanging so flaggy before its mouth, that when any thing would enter in, it claps close upon it and stops it.

As to any *Anastomoses* of the roots of any of these Biliary vessels, with those of the *Vena Porta*, nor Anastomoses with the Porta. such indeed have been much talk'd of, but without truth, for their extreme Twigs or Capillaries terminate in the *Parenchyma* of the Liver, out of whose Grape-stone-like Glandules they imbibe the Choler there separated from the Blood; even as was said before of the Capillaries of the *Cava*, that they received the Blood is first imported by the *Porta*, in like manner, without any inosculation.

The Use of all these Vessels may sufficiently be learned by what has already been said of them. Though some are of opinion, that not only Choler, but other superfluous humours are evacuated by them, especially upon taking a Purge. The use of the Vesica, ductus cyst-hepaticus, and porus.

The

The Use of the Bile it self appears from what we quoted above out of *Diemerbroeck*, when we were treating of the action of the Liver, *cap. 12.* We will only farther note two things.

Observ. 1. First, That sometimes the *Ductus communis* is very irregularly inserted. For in some it is sent to the bottom of the Stomach, and then the party vomiteth Choler, and is termed *μαεγόλητος* and sometimes it is inserted into the lower end of the *Jejunum*, and then bilious defjection is follow; and such a one is termed *μαεγόλητος ὑγιεινός*.

Observ. 2. A second thing is concerning the colour of the Bile; that though for the most part, in a healthful state, it be yellow, yet preternaturally and in a morbus state it is often of several other colours, as pale-coloured, eruginous, porraceous, vitelline, reddish and blackish. And when it thus degenerates and corrupts, it is the cause of most violent and acute Diseases; as the *Cholera morbus*, *Dysentery*, *Colick*, &c.

C H A P. XV.

Of the Pancreas.

The Pan-
creas.
Its Sub-
stance.

THE *Pancreas* (as much as to say, *All-flesh*) or the *Sweet-bread*, except its Membranes and Vessels, is wholly Glandulous. It seems to be compacted out of many Globules or knots included in a common Membrane, and joynd one to another partly by Membranes, and partly by Vessels. Every Globule by it self is somewhat hard; but all together (because of their loose connexion) seem softish. It is of a palish colour, very little tinged with red. Its investing Membrane it has from the *Peritonæum*.

It is *seated* under the bottom and towards the *Situation,* hinder side of the Stomach, and reaches from the *and con-* Cavity of the Liver, (namely from that part *nexion.* where the *Porta* enters it) to the lower end of the Spleen cross the *Abdomen*. It is annexed (by its *Duct*) to the *Duodenum*, and sometimes to the *Ductus biliaris*, to the *Rami splenici*, the Caul, the upper part of the Mesentery, and upper *Nervous plexus* of the *Abdomen*. It is not joyned to the Spleen.

Its *figure* is long and flat, broader and thicker *Figure.* about the *Duodenum*, but towards the Spleen thinner and straiter.

It is lesser than most of the *Viscera*, commonly *Bigness.* about five Fingers breadth long: where it is broadest, it is about two Fingers breadth, and about one Fingers breadth thick.

Its *Vessels* are of five kinds. *Veins* it has from *Vessels.* the splenick branch; *Arteries* from the left branch of the *Cœliaca*, sometimes from the Splenick; *Nerves* from the Intercostal pair, especially from the upper *plexus* of the *Abdomen*; it has also many *Vasa lymphatica*, which, as the rest, pass to the *Receptaculum chyli*.

But besides these *Vessels* which are common to *Ductus* it with other parts, it has a proper membranous *pancrea-* *Duct* of its own, which was first found out by *ticus.* *Wirsungus* at *Padua* above 40. years ago. This *Vessel* commonly has but one *Trunk*, whose orifice opens into the lower end of the *Duodenum* or beginning of the *Jejunum*, and sometimes is joyned to the *Ductus biliaris*, with which it makes but one mouth into the Intestine. Within the *Pancreas* (according to *Dr. Wharton*) it is divided into two Branches, which send forth abundance of little *Twigs*, into all the *Glanduli* above spoken of, where they imbibe the Humour that is separated

rated by them from the Arteries, and by their Trunk transmit it to the Guts. This Pancreatic humour though is never found in this Duct, because it flows so quickly out of it into the *Duodenum* by a steep way; even just as the Urine, passing out of the Reins by the Ureters to the Bladder, is never found in them because of its rapid transit.

Office.

Very many have been the differences of Opinions concerning the *Office* of this Glandule. Some have thought it to be only of use to sustain the divisions of the Vessels, and to serve the Stomach for a Cushion to rest upon; others, that it ministers a ferment to the Stomach; others, that it receives the Chyle, and brings it to greater perfection; and others, that it serves as a Gall-bladder to the Spleen, or sometimes serves in its stead. Which Opinions being all very unlikely, I shall not spend time to examine them.

*The nature
of the pan-
creatick
juice.*

There are three other Opinions, for the *first* whereof let the credit of the learned Author (*viz.* Dr. *Wharton*) recommend it as it can, but to me it seems improbable, and it is this, That it receives the Excrements or Superfluities of the superiour *plexus* of the Nerves of the sixth pair, (Dr. *Willis*'s Intercostal or ninth pair) being united with some branches from the spinal marrow, and by its proper Vessel or Duct discharges them into the Intestins. In answer unto which I shall only say this, That I cannot tell how thick Excrements should be convey'd by the Nerves that carry such pure Animal Spirits, and have no visible Cavity; nor secondly, how these Nerves in particular should *cum delectu* as he speaks send the Excrements hither, and all the rest be discharged from any such Office.

The

The *second* Opinion is somewhat more probable, and is defended by famous Physicians and Anatomists, as *Franc. Sylvius*, *Bern. Swalve*, *Regn. de Graef*, and *Isbrand de Diemerbroeck*, from which last I shall transcribe it. "I have found, *says he*, "in the Dissections of Brutes both alive, and "newly strangled, a certain liquor sublimpid, "and as it were salivous, (something austere "and lightly subacid, and having sometimes "something of saltishness mixed) to flow out of "the *Ductus pancreaticus* into the *Duodenum*, "sometimes in a pretty quantity. Whence I "judged—that there is excocted in the *Pancreas* "a peculiar humour from the serous and saltish "part of the Arterial blood brought into it, having some few Animal Spirits convey'd thither "by small Nerves mixed with it, and that this "liquor flowing into the *Duodenum*, and there "presently mixed with the Bile, and the Meat "concocted in the Stomach gliding by the *Pylorus* into the Guts, does cause a peculiar effervescency in those Aliments, whereby the "profitable chylous particles are separated from "the unprofitable, are attenuated, and being "brought to greater fusion (This Operation of "it, *says he*, is shewn by the diversity of the substance of the Aliments, concocted in the Stomach, and still there contained, from that of "those which have already flow'd into the Intestines: for the former are viscid and thick, "and have the various colours of the food taken: "but the latter on the contrary are more fluid, "less viscid, and more white) are wickal made "apt to be impelled by the peristaltick motion "of the Guts, through their inner mucous Coat "into the Lacteal vessels, the other thicker by "little and little passing down to the thick Guts,

"to

“to be there kept till the time of excretion.
 “Now this effervescency is caused through the
 “volatile Salt and sulphureous Oyl of the Bile
 “meeting with the acidity of the Pancreatick
 “juice; as in Chymistry we observe the like
 “Effervescencies to be caused by the concurrence
 “of such things.] Thus he. So that he will not
 have this Juice to be any thing excrementitious,
 nor to be so very little in quantity, as some have
 affirmed; to demonstrate which he cites the Ex-
 periment of *de Graef*, who in Live-dissections
 could gather sometimes an Ounce of it in seven or
 eight hours time, which he has tasted, and found
 it of the taste before-mentioned, viz. something
 austere, subacid and saltish. *Vide ejus Anatomia-*
corporis humani, p. 73, &c. where you may see
 what Diseases it is the cause of when disordered.

A third Opinion is that of *Brunnerus*, who
 thinks that the *Pancreas* is of the same use with
 the other conglomerate Glands of the Mouth,
 Throat, Stomach, and Guts, and its Juice of the
 same nature with the *Saliva*. That it consists of
Lympha separated from the Arteries, and of Ani-
 mal or Nitro-aereal Spirits communicated by the
 Nerves. That like the *Saliva* it is a Dissolvent
 or *Mensivum* in concoction and chylication, but
 does not ferment with the Bile, but only takes
 somewhat off its Acrimony. That its juice is
 not of any peculiar sort, he endeavours to evince
 by repeated Experiments upon Dogs, from some
 of whom he cut the greatest part of the *Pancreas*,
 and in others cut asunder its Duct that passes
 from it to the Intestins, and yet they continued
 (after two or three days indisposition) to be as
 lively, and in every respect in the same condi-
 tion as before. From whence he concludes, that
 that juice which naturally flows out of the *Pan-*
creas,

creas, must in these cases be supplied from other parts; and therefore that it is of no *peculiar* nature, but of the same with that of those parts that supply its defect, and those can be no other than the conglomerate Glands of the parts aforesaid. He that would be further satisfied in the grounds of this Opinion, or how this ingenious Author made his Experiments, may consult his Book lately published, entitled, *Experimenta nova circa Pancreas, &c.*

C H A P. XVI.

Of the Spleen.

THE Spleen is so called in *English*, from the *The Spleen*, *Greek* *Σπλῆν*, from whence also the *Latin* *its name*. word *Splen* is derived. It is otherwise called in *Latin*, *Lien*, and in *English* the *Milt*.

It is commonly but one in Men, though some *Number*, have found two, yea *Fallopian* three. In Dogs there are sometimes two or three, unequal in bigness, out of each of which there passes a Vessel into the *Ramus Splenicus*.

In Infants new-born it is of a red Colour: in *Colour*, those of a ripe age it is somewhat blackish; and in old men it is of a leaden or livid colour.

In Man it is broader, thicker, and heavier than *Bigness*, in Beasts; for it is about six Inches in length, three in breadth, and one in thickness. Sometimes it is much larger, but the bigger the worse. *Spigelius* has observed, that it is larger in those that live in fenny-places, than in those that live in dry; and in those that have large Veins, than in them that have small.

Figure.

As to its *figure*, *Hippocrates* compares it to an Oxe's Tongue ; *Aristotle* to an Hog's Milt. Towards the Stomach on its inner-side it is somewhat hollow ; on its outer, gibbous, having sometimes some impression upon it from the Ribs. It is smooth and equal on either side, save where in its hollow side it has a streight line or seam (*πάσι*) at which place the Splenick-vessels enter into it. Its upper end is called its *head*, and the lower its *tail*.

Situation.

It is seated in the left *Hypochondrium* opposite to the Liver : (so *Hippocrat.* 6. *Epidem.* calleth it the left Liver ; and *Aristot.* 3. *de histor. animal.* 7. the bastard Liver) betwixt the Stomach and that end of the Ribs next the Back ; in some higher, in others lower : but naturally it descends not below the lowest Rib. Yet sometimes its Ligaments are so relaxed, that it reaches down lower ; yea sometimes they quite break, so that it slips down into the *Hypogastrium* : so *Riolanus* tells the story of a Woman that was troubled with a Tumour there, which was taken by her Physicians for a Mole ; but dying of it, and being opened, it was found to be occasioned by the Spleen fallen out of its place, and lying upon the Womb.

Whether it may be cut out of the body with safety.

And whereas it very much endangers life when it falls out of its place, one would think that it could not but with great danger be cut out of the body. For how can one imagine that a part so difficult to come at, and that has such large Vessels inserted into it, (not to mention its use) can with safety be taken out of the Body ? Wounds in it are commonly mortal ; Inflammation, or but Obstructions in it do grievously afflict the Patient, and sometimes kill him : sure then the total ablation of it one would think should be very fatal. And yet (among others) the ingenious

nious *Brunnerus* in the Preface to his above-cited Book affirms, that he first took the Spleen from a Dog, and at some distance of time by a second Operation cut out the greatest part of the *Pancreas* from the same, and yet he continued to eat and drink, shit and piss, and run about as briskly as if he had wanted neither of them, till about three Months after the last Operation he was lost in a crowd. And *Malpighius* relates, how having tyed all the Vessels that come into or go out of the Spleen in a young Dog, (which is much the same thing as to cut it out) and closed up the wound in his side after the Operation, tho' hereby when the same side after a good while was open'd again, the Spleen was dried up almost to nothing; yet in the mean time the Dog was every way both as to his stomach, excrements, plight, briskness, &c. as well as before the Ligation. And *Ant. Nuck* tells us of a Dog out of whom he cut not only the Spleen, but one Kidney also, having first fast tyed the Vessels that go to and spring from each; and afterwards healing up the wound, the Dog continued in good plight.

It is tyed to five parts; its upper part to the *Connexion*, Midriff (commonly) and its lower to the left Kidney by thin Membranes; by its hollow part which giveth way to the Stomach being distended, to the upper Membrane of the *Omentum*, and to the Stomach by sundry vessels. Its gibbous or arched part is knit to the *Peritonæum* by thin Membranes.

It is clothed with a double *Membrane*; the out-*Membranes* ter, common, being propagated from the *peritonæum*, (or as some will have it from the *Omentum*:) the inner, proper. The first is strong, and contains the Spleen as in a bag: Both Veins, Arteries

teries and Nerves run along it, and betwixt it and the inner a great number of Lympheducts. The Arteries that run through the inner Substance of the Spleen, do many of them terminate in it; so that when it is pulled off, (which 'tis not hard to do) you may discern a great many red specks, which are the little mouths of the broken Arteries. The inner Membrane is smooth and strong, but not so dense but that Air can pass through it, if one blow hard into the Spleen by the splenick Artery, after the outer Membrane is drawn off. Some think this Coat springs from the outer one of the Vessels that enter the Spleen: *Malpighius* supposes it to be woven by an Implication of the Fibres that run overthwart the Spleen. Blood-vessels run along this also, as one may observe by syringing Ink into the Splenick Artery; for then they are discover'd both by their swelling and alteration of colour.

Substance. The substance of it is flabby, loose, and spongy, commonly held to be a concrete sanguineous body, serving to sustain the vessels that pass through it: but *Malpighius* with his Microscope has discover'd it to be (besides the Fibres, to be describ'd by and by) a Congeries of Membranes form'd and distinguish'd into Cells, in which are included very many Glands. These Cells and Glands he describes thus in the *fourth* and *fifth* Chapters of his *lib. de Liene*. "Though the
 "Spleen by its colour and looseness of substance
 "seem to be flesh, or concreted blood; yet if
 "one tye the Artery, and blow hard by the
 "Vein, (or on the contrary) the Spleen will ex-
 "ceedingly swell; and being thus blown up, if
 "it be dried, and afterwards cut, you may per-
 "ceive its whole bulk to be made up of Mem-
 "branes forming *Sinus's* and Cells like Honey-
 combs.

“combs. They are propagated either from the
“investing Membrane, or (which he thinks
“more probable) from the venous duct that runs
“along the middle of the Spleen; like as the
“Cells in the Lungs, he thinks, proceed from
“the Branches of the *Trachea* growing slender.
“Their shape is irregular; they communicate
“with one another, and gape not only into the
“extream branches of the Splenick Duct, but al-
“so into the sides of the trunk it self, by means
“of the holes or pores therein (to be described
“by and by.) They are watered with Blood-
“vessels, and within them are included nume-
“rous bunches of Glands, or if you will, of
“Bladders or little Bags, which do exactly re-
“semble a bunch of Grapes. These little Glands
“have an oval figure, and are about as big as
“those of the Kidneys: I never saw them of
“other colour than white; yea though the Blood-
“vessels of the Spleen be fill’d with Ink, and play
“about them, yet they always keep the same co-
“lour. Their substance looks as if it were mem-
“branous, but ’tis soft and easily crumbled; their
“Cavity is so small that it cannot be seen, but
“it may be guessed, in that when they are cut
“they seem to fall into themselves. They are
“almost innumerable, and are placed wonderfully
“in the aforesaid cells of the whole Spleen, where
“vulgarly its *Parenchyma* is said to be; and
“they hang upon fibres arising from their case,
“and consequently on the utmost ends of the
“Arteries and Nerves, yea the ends of the Arte-
“ries twist about them like the Tendrils of
“Vines, or clinging Ivy—Each bunch consists
“of seven or eight. —Besides the membranous
“cells that enclose them, they are covered with
“a bloody substance, which plentifully stagnates

“in those cells; as appears by syringing water
 “by the Artery into the Spleen, for it will be
 “tinged after several repetitions, and bring a-
 “bundance of blood out with it.] Thus he.

Fibres.

From the inner Membrane (according to *Malpighius*) spring innumerable *fibres*, which run across the Spleen to the opposite part of the same Membrane, or to the *Capsula* or common case of the vessels which runs through the middle of the Spleen. They keep not the same plane, but ever and anon being split into two, they each inosculate with others in like manner divided, and make a sort of Net-work. The Ancients believed them to be twigs of blood-vessels; Dr. *Cliffon* supposes them also to be vessels, but that they contain not blood, but nervous juice: But *Malpighius* concludes them to be only fibres, because they have neither any discernible cavity, nor any communication with vessels; and also because both *Spigelius* and himself have observed the inner membrane of the Spleen, which affords rise and insertion to them, and is framed of a *plexus* of such like fibres, to become bony and sometimes cartilaginous, which he thinks cannot easily agree with the nature of vessels. Their use he thinks to be only for the strengthening and conservation of the soft structure of the Spleen.

To these opinions of *Malpighius* concerning the glandules and fibres of the Spleen have later Anatomists generally subscribed: But Dr. *Fred. Ruysch* has expressd his dissent therefrom in an Epistle to *Campdomercus* (lately published.) He says, “That the whole fabrick of a *Man's* “Spleen is nothing but a certain *congeries* of Ar-
 “teries, Veins, Lympheducts and Nerves, which
 “are infolded in the investing membranes. But
 “it is to be noted (*adds he*) that the protracted
 “and

"and extreme *propagines* of the Arteries and
 "Veins seem to acquire another nature, for they
 "are so soft and juicy, that they may easily be
 "reduced in a manner (as I may say) to nothing;
 "for their extreme particles are dissolved by the
 "least rubbing that may be: yea by only steeping
 "them in fair water till they are a little rotten,
 "they dissolve into a brown or black-ruddy liquor.
 "These extreme parts, I say, are mere *propagines*
 "of the blood-vessels; and there is no other rea-
 "son why they represent glandules, but because
 "they are disposed *fasciculatim* or in clusters, and
 "are reduced into softer, more juicy and round bo-
 "dies, which hath imposed not only upon others,
 "but till of late upon my self also. But these *pro-*
 "*pagines* thus disposed in clusters are to be distin-
 "guished from glands, seeing they are not covered
 "with any peculiar membrane, nor consist by
 "themselves, which is required in glands; —
 "They are placed very close to one another,
 "without any (natural) visible empty space be-
 "tween, or cell, though *Malpighius* describe, and
 "*Bidloe* draw all these things.]

Thus far as to the *glandules*: Then he proceeds
 to the *fibres*, and says, "That though he has used
 "the utmost diligence, he never found such fibres
 "in a *Man's* Spleen. He confesses indeed that the
 "matter is so in a *Calf's* Spleen; *viz.* that there
 "are in it innumerable fibres, betwixt which the
 "aforesaid *propagines* or clusters are seated: And
 "these fibres seem to be of great use in a *Calf's*
 "Spleen, *viz.* that they may establish the *sulci*
 "that are found in a *Calf's* Spleen (that are in
 "lieu of the venous branches) that they may not
 "be too much extended by the reflux blood.
 "But in a *Man's* Spleen that has no *sulci* &c
 "Veins, such fibres are not necessary.

Lastly, as to the *cells* so often mention'd in *Malpighius's* description of the substance of the Spleen, *Dr. Ruysch* tho' he grant "that in a Calf's Spleen there is something like cells (for the texture of the aforesaid fibres resembles the little holes of cells) yet in a Man's (well constituted) he never found any such thing.

Vessels.

It hath *Vessels* of all kinds; as 1. *Veins* from the *Ramus splenicus* of the *Vena porta*. The *Ramus* before it enter the Spleen has two Coats, but in its entrance its outer and thicker is received by the inner Coat of the Spleen, which (according to *Malpighius*) turning back enters into it, and becomes a *Capsula* or common cover for both Veins, Arteries, and Nerves. And whereas Anatomists did formerly teach, that this Vein upon its entrance into the Spleen, did presently divide it self therein into sundry branches, and so was all equally obliterated in its Membranes and *Parenchyma*: he affirms, that there is formed out of it a large venous *Duct* or *Sinus*, that runs quite through the Spleen, (somewhat like that in the *Pancreas*) into which the blood (howsoever alter'd) is received through the Glands from the Arteries: And because he could never trace the Veins so far as the Glands, he believes that the blood, &c. is conveyed into the aforesaid venous *Duct* by such-like *tubuli* or pipes as the milk is stored up in and issues out of in Women's breasts: and that by making some stay in these, it acquires some new mixture and alteration. That the same such *tubuli*, appears from his own observation, (and from *Dr. Glisson's* before him) that the Veins (especially the venous *Duct* before-mentioned) have abundance of little holes or pores in their sides, (every where save on that side under which the Arteries and Nerves run)

The venous duct and tubuli.

run) which are extended into the *Parenchyma* of the Spleen, and constitute these little pipes.

Dr. *Ruysch*, as in other things he dissents from *Malpighius* as to the substance of a Man's Spleen, so also in the particular of the holes in the sides of its Veins; for he sayes, a mans splenick vein is not full of holes like a sieve, as a Calf's is, nor does it end into *fulci* like that.

This Vein enters the Spleen sometimes in one and sometimes in more branches: but whether they be one or more, they have each one a Valve, which looks from the Spleen outwards, permitting the humours to flow from the Spleen to the *Ramus splenicus*, but hindring them from returning back. And though one cannot discover any Anastomoses of the Veins with the Arteries in the substance of the Spleen, yet there is one notable one of the Splenick Artery with this *Ramus splenicus* before it enter the Spleen. Whose use must be, partly to further the motion of the humours contained in the *Ramus* towards the Liver, partly that the superfluous plenty of Blood, which perhaps cannot pass quick enough through the narrow passages of the Spleen, may return back again by help of this Anastomosis, through the *Ramus* to the Liver. There are also two Veins that open into the *Ramus* at a little distance from the Spleen; the one called *vas breve* (but should rather be called *vasa brevia*, there being for the most part several) which ariseth out of the bottom of the Stomach: (The Errour of the Ancients as to the use of this Vessel was detected before, chap. 12. and its true use declared:) and the other the internal Hemorrhoidal.

It hath two Arteries, entring one at its upper, ^{2. Ant.} the other at its lower part. These commonly ^{ies.} spring from the left Coeliac branch, which is

called the *Splenick Artery*; but sometimes (saith *Diemerbroeck*) from a certain branch which ariseth out of the very trunk of the *Aorta*, and proceeds by a bending passage along the side of the *Pancreas* to the Spleen, approaching whereto it is divided into two, and these branches entring it as aforesaid, they are subdivided through it into a thousand twigs, the most of which terminate in the oval Glands above-described, and the remainder are spent partly on the Membranes that make its cells, and partly on the investing coats, as may be made to appear by filling this Artery with ink or Air.

3. *Nerves*. Its *Nerve* is one of the left mesenterical branches of the Intercostal pair, which at its entrance into the Spleen, is ordinarily divided into two branches, which are inclosed in the common case, running by the sides of the Artery, or sometimes above it, but under the Vein: Its subdivisions do inosculate with one another, and accompany the bifercations of the Arteries within one cover through the whole substance of the Spleen, entring the Glands with the Arteries. Contrary to what has been formerly taught, that they are all spent on its investing Membrane; which was supposed, because the body of the Spleen has but a very dull sense: But that proceeds not from defect of Nerves, (seeing it has a pretty many twigs) but probably from that *stupor* or numbness which that acid juice that is bred in the Spleen, may be conceived to induce upon them.

Their Capsula. *Malpighius* in his accurate Anatomy of the Spleen, hath found out a considerable Membrane not observed by former Anatomists, which from its cloathing or inclosing the Blood-vessels and Nerves, he calls a *common case* or *capsula*. It has its rise from the inner and proper invest-

ing

ing Membrane of the Spleen, (as was said before in the description of the Veins) which being turned back in the ingress of the vessels enters to within the Spleen, and being formed into a pipe incloses the trunks and branches also of the aforesaid vessels, which spring out of each side of the long *duct* or *sinus*, somewhat like the leaves of Fern. It has such like holes in it as the Veins before described: and the fibres of the Spleen do very many of them either arise from, or else are inserted into it.

Though Dr. *Wharton* in his *Adenographia*, cap. 4. 4. Vasa going about to prove the Spleen to be no Gland, Lymphatices this as one Argument, That there were never observed any *Lympheducts* to be distributed through this part: yet *Olaus Rudbeck*, *Fr. Sylvius*, *Fred. Ruysch*, *Malpighius*, &c. affirm it to have many, which arising from its conglobate Glands pass through the *Omentum* very plainly into the *Receptaculum chyli*. See them exprest in the following figure of a Calf's Spleen.

The Ancients knowing neither the true passage of the Chyle, nor the circulation of the Blood, erred grossly as to the use of this part. They thought that it attracted a more feculent and melancholick part of the Chyle, by the *Ramus splenicus*, from the Mesaraick veins, which having elaborated, it sent it out again partly by the *vas brevie* to the Stomach to excite the appetite and further the concoction thereof, and partly by the internal Hemorrhoidal: but it is certain, that no Chyle, nor indeed Blood passeth by the *Ramus splenicus* to the Spleen, as neither any thing from the Spleen by the aforesaid Vessels; but whatever they contain, comes towards the Spleen, namely into the *Ramus*, and what is in it, goes to the Liver. One need add no further

ther reason to evince the error of their Opinion; nor that of those that would make it either a blood-making, or a blood-perfecting Bowel. Dr. Glisson (in *lib. de Hepate*, cap. 45. pag. 434) thinks it to make an Alimentary juice, or at least a vehicle for it, which being first imbib'd by its nervous Fibres, is from them received into the Nerves, by which it is first carried to the *Glandulae renales*; where being refin'd, it is received again by the Nerves, and is carried to the Brain and Spinal marrow, and from thence by the Nerves again into all the parts of the Body. We will not here enter into a dispute about the nutritious juice of the Nerves; but supposing it, certainly this seems an odd way of conveying either it or its Vehicle thus to and again by the same sort of Vessels; not to say that so acid a juice as is excocted in the Spleen, one should think, would be no very welcom guest to the Nerves, nor be suffer'd to march so quietly, especially passing against the current of the Animal Spirits that continually flow from the Brain and Spinal marrow. This Opinion therefore we shall pass by as very improbable, having little else to recommend it save the credit of its learned Author.

Velthufius says, That whatever is more thick and feculent in the Chyle and Blood, is drawn to the Spleen, and there by fermentation is brought to a state of fusion and volatility, from whence store of Spirits are bred in the blood; for 'tis by fermentation alone, says he, that Spirits are extracted out of any body.

Dr. *Mayow* according to his Hypothesis, that the ferment of the Stomach consists of Nitro-aereal Particles supplied by the Nerves, and that the ferments in all the other *viscera* consist of the same,

same, assigns these three uses to the Spleen.

1. That the Nitro-aereous Particles which passing through the Brain in a continued *series*, are not spent on the natural or animal functions, may be reconveyed (by those Nerves that go to the Spleen, and which have communication with most of those that are bestowed on the *viscera* in the *Abdomen*) into the mass of blood, and rightly mixed with it in the Spleen. 2. That the Nitro-aereous Particles may be carried in a due plenty and with a certain regimen to the *viscera* appointed for the concoction of Meats. For accordingly as those *viscera* are full or empty of Aliment, so they have need of a greater or less afflux of fermentative particles. 3. That the Nitro-aereous particles being put in motion and vigour, and intimately mixed with the Salino-sulphureous particles of the blood in the Spleen, may excite such an effervescency in the mass of blood, as may be fit to bring its Salino-sulphureous particles to a due volatility.] Whence, seeing these offices of the Spleen, are not so necessary, but that life may be continued without them, though they much conduce to the right disposition of the Animal Oeconomy and to a perfect health ; I say on this account he thinks it not difficult to understand how it comes to pass that an Animal may live that has it cut out.

Blancard gives this as his Opinion. " The numerous Grape-stone-like Glands without doubt receive a Lymphatick humour from the Arterial Blood, which is carried by Lymphatick vessels, plain enough to be seen on the limous side of the Spleen, to the receptacle of the Cnyle. The blood being thus deprived of a too great quantity of this liquor, is made so much the fitter to have the Bile separated from
" it

“ it in the Liver. Thus also all the blood that
 “ is to go to the Liver, whether in the Spleen,
 “ or in the Intestins, or in the Stomach, does
 “ first part with its too thin juice. For this rea-
 “ son the Spleen is made livid, and all the blood
 “ that enters the Liver, is far blacker than that
 “ which is contained in the *Vena cava*. But the
 “ young Student will ask why the liquor is sent
 “ from the Lymphatick Vessels of the Spleen into
 “ the Recepracle of the Chyle? I answer, That
 “ through the mixture of liquors whose particles
 “ are of divers kinds, the Chyle might (by fer-
 “ menting as it were, as appears in Chymical
 “ mixtures) be made the more perfect.

Dr. *Havers* (in his *Osteologia nova*, p. 210, &c.)
 inquiring into the generation of the *mucilage* that
 lubricates the Joints, &c. thinks, that the change,
 which that part of the blood from which it is pro-
 duced, undergoes in order thereunto, is made
 by some gland; and that there is none which
 seems so fit and likely to be concerned in this
 affair as the Spleen, which he supposes to be the
officina, where nature produces and elaborates
 the mucilage, from whence it is administered to
 the blood, and by that dispensed in its circulation
 to all the parts, about which 'tis necessary it
 should be employed. The reasons of this his
 opinion, the Reader may see in the place quoted.

The last, (and to me the most probable) *use*
 is this, *viz.* That it serves to make a subacid and
 saltish juice of the Arterial blood and Animal
 Spirits that flow plentifully into it, which pas-
 sing by the *Ramus splenicus* to the Liver, serves
 there to make (and further the separation of) the
 Bile, which is the proper action of the Liver, as
 was shewed before, *chap.* 11. Now this juice is
 thus elaborated: The bulk of the Spleen consist-
 ing

ing mostly of membranous cells inclosing bunches of Glands, as we shewed before from *Malpighius*, into these the Arterial blood is poured by the capillary Arteries wherewith are mixed some Animal Spirits deposited into the same by the ends of the Nerves, which bridling the Sulphureous Spirit of the Blood, induce on it a little acidity; and then being driven out of the Cells and Glandules, by the beating of the Arteries and the pressure of the adjacent parts, it is received into those *tubuli* before spoken of, and so into the large venous duct, from whence it flows into the *Ramus splenicus*, and by it is conveyed to the *Porta* and Liver. But it does not pass hastily through the Spleen, but seems to make some stay in the abovementioned Cells and Pipes, and also in the venous duct, that it may acquire some more acidity by its stagnating in them: as Wine standing in a Vinegar-vessel fours more and more; and as the Bile by staying in the Gall-bladder gets a greater acrimony. And this stay of the blood in the *tubuli* and venous duct, *Malpighius* assigns this reason of, *viz.* because they are so much more capacious than the Arteries that bring the blood into them; so that the current could hardly be continued in them by the impress or propulsion of the Arterial blood, if it were not furthered by the motions of the adjacent *viscera* and Intestins squeezing as it were the Spleen against the Ribs. That the Spleen does minister to the action of the Liver, and not to sanguification (amongst other reasons) may be presumed by this, that the Blood takes so long and tedious a march from that to this by the *Ramus splenicus*; whereas it might readily have been conveyed into the trunk of the *Cava* that is hard
by

by the Spleen, if the juice that is elaborated in it had not been for the service of the Liver.

Tab. IV. Represents the Pancreas, and the Spleen with its Lympheducts.

Fig. 1. Represents the Pancreas.

AA The Parenchyma of the Pancreas opened.

B The Trunk of the Ductus pancreaticus.

CCC Its Branches.

D The Ductus bilarius joyning to the Pancreatick Duct.

E The Duodenum opened.

F The insertion of these Vessels.

Fig. 2. Represents the Lymphatick and Sanguineous Vessels of the Spleen tied.

A The Spleen of a Calf.

B The Sanguineous and Lymphatick Vessels tied.

C The Splenick Vein.

D The Splenick Artery.

E The Splenick Nerves, whose number is uncertain.

F The Lymphatick Vessels arising out of the outer part of the Spleen.

ffff The Valves in the said Vessels.

G The Ligature.

Fig. 3. Represents an Oxe's Spleen, from Dr. Highmore.

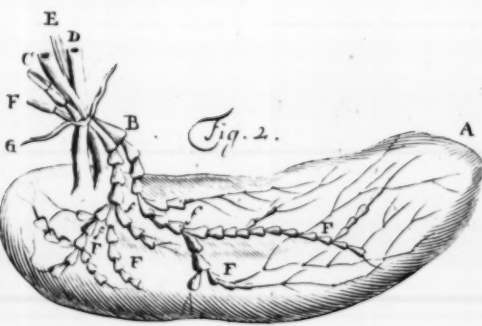
AA The substance of the Spleen cover'd with its proper Coat.

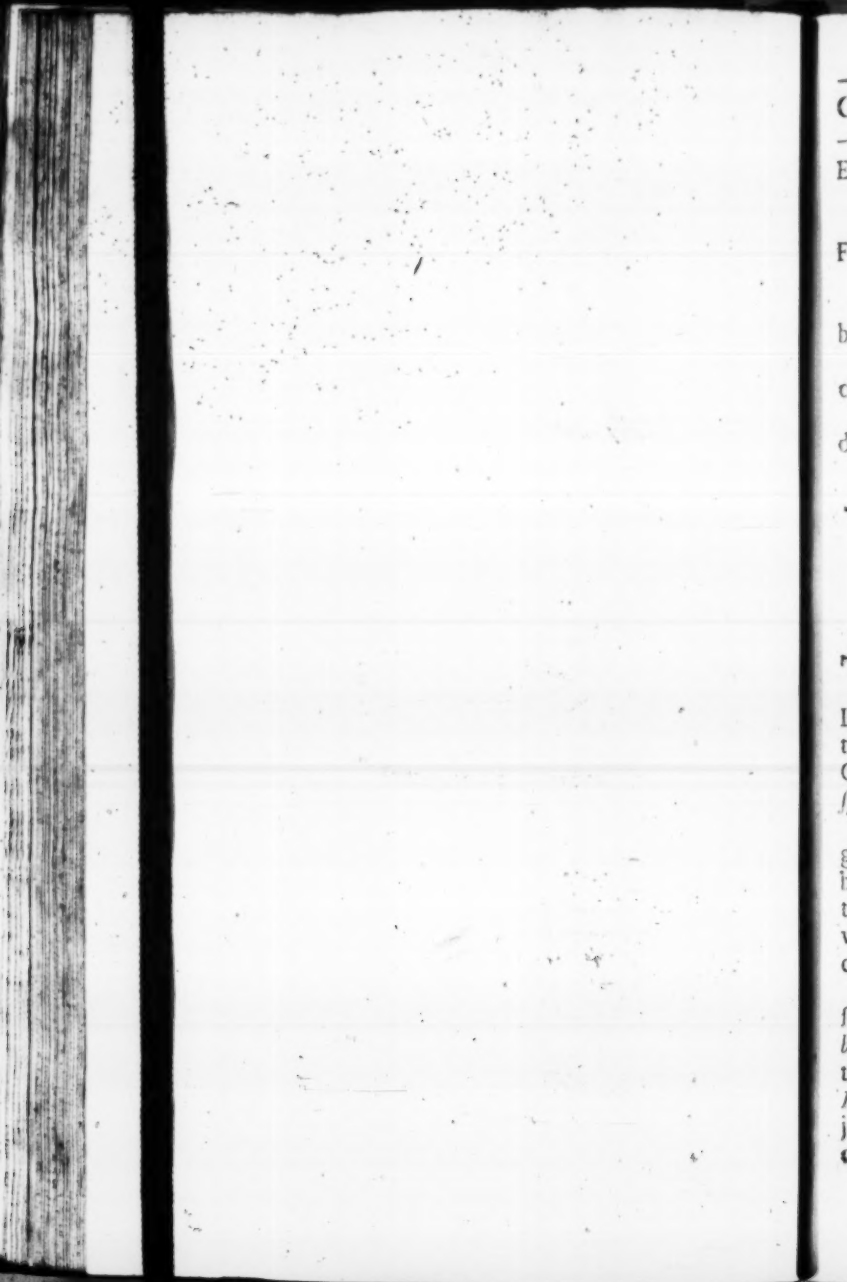
B A portion of the Vena portæ.

C Its left, or Splenick Branch.

D This Branch opened near the Spleen that the Valve D. may appear.

EE The





EE The Coat of the Spleen dissected and turned back, that the progress and plexus of the Vessels and Fibres may be shewn the better.

F A portion of the Splenick Artery, which running through the whole substance of the Spleen, doth dispense into it the little Twigs aaa.

b The Valve in the Splenick branch looking outwards to the Porta.

ccc The holes which appear in the Ramus splenicus leading from the substance of the Spleen.

ddd Nerves running along the sides of the Splenick Artery.

CHAP. XVII.

Of the Kidneys, and the Glandulæ renales.

THE Kidney is called in Latin *Ren*, from *The Kid-*
neys. *flow* to flow; because the serosity of the Blood doth flow through the Kidneys to the Ureters, and through them to the Bladder. By the *Their*
name. Greeks they are called *νεφει*, à *νεφειν* *ningere*, or *spargere*.

They are in *Number.* number two, both because of the great quantity of the serous Excrement that is to be separated and discharged by them; and also that one being stopped by a Stone, or otherwise violated, the serum of the Blood might be transcolated by the other.

They are *Situationa.* seated behind the Stomach and Intestines in the Loins, one on each side of the Vertebrae, between the Membranes of the Peritoneum; their lower end rests on the head of the Muscle *Psoas* (which is one of the movers of the Thigh) just where the Nerve enters into it, which is the cause that a big stone being in the Kidney, and pressing

pressing on the Nerve, a numbness is felt in the Thigh of the same side. In Man the right Kidney is lowest, by reason of the greatness of his Liver, and commonly bigger also than the left; yet it has not so much fat about it as the left, by reason of the vicinity of the Liver, whose heat hindreth the encrease of fat.

Figure.

In figure they resemble the *Asarum* leaf, or a Kidney-bean: towards the Loins or outwards they are gibbous; and also in their ends on the inside; but in the middle where the Vessels enter in and go out, they are hollow. Their surface in grown persons is smooth, but in the *Fetus* and Infants it is very unequal, as may be seen in the following figure of the Kidneys of an *Embryo*.

Connexion.

As for their *connexion*; by the external fatty Membrane they are tyed to the Loins; by the emulgent Vessels, to the *Vena cava*, and the *Aorta*; and by the Ureters to the Bladder. The right hath the *Intestinum cæcum* joyn'd to it, and sometimes the Liver; the left hath the Spleen and the *Colon*.

Bigness.

They are in length about five Inches reaching the length of three and sometimes four *vertebrae*; betwixt two and three fingers breadth broad, and one Inch thick. In salacious or lustful Men, they are commonly larger than in others.

Membranes

Their *Membranes* are two. The outer is common, borrowed from the *Peritonæum*; within the reduplication of which the whole Kidney is wrapped; and therefore it is called *Renis fascia*. This Membrane is besmeared with much fat; whence it is called *Tunica adiposa*; and into it entreth the *Arteria adiposa* from the *Aorta*; as also the *Vena adiposa*, which on the right side commonly ariseth from the Emulgent, seldom from

from the *Cava*; but on the left, always from the *Cava*. By means of this Membrane 'tis that they are both joyned to the Loins; the right, to the *Cacum* and sometimes to the Liver; the left, to the Spleen and *Colon*, as was noted before.

Many Uses have been assigned to the fat collected in this Membrane; as, to serve for a soft swathing-band to the Kidneys; to preserve the hot and moist temperament of them, which otherwise would necessarily be resolved by the continual affusion of the serous Excrement, &c. But *Malpighius* thinks it more probable, that seeing much fat bedaubs the Vessels that enter into the hollow side of the Kidneys, not only before their entrance but after, and that the same is extended to the Membranes of the *pelvis* and all its pipes, that therefore its chief use is, to besmear the said Vessels through which the Urine passes, that they may not be fretted and exco-riated by its acrimony and saltness.

The *inner* is *proper*, and seems to be connate with them, and not propagated from any part. It adhereth very close to them, and has inserted into it small Nerves from the Intercostal pair, and one twig from that particular branch thereof which goes to the Stomach; whence that consent betwixt the Kidneys and Stomach, that in the pain of the Stone in the Kidneys, a vomiting is caused. But these Nerves enter the *substance* of the Kidneys in but very few and those small slips, whence it has but a dull sense. The emulgent Vessels as they penetrate this Membrane, are said to borrow from it a *Capsula* or common cover, (wherein they are both included;) as the Vessels of the Spleen, and the *Porta* and *porus biliaris* of the Liver, do from the Coat of their respective

* De
struct.
Ren. p.
59, 60.

spective *viscera*, as was shewn above in their description. But * *Bellini* says, that these Vessels in the Kidneys borrow their *Capsula* from the Membranes of the *pelvis*, within which they are disperied presently upon their entrance into the Kidneys, and springing out of them again run to the cortical or superficial part of the Kidneys clad with a common *Capsula* from those Membranes.

Substance.

As to the *substance* of the Kidneys (excepting the vascular part) it has been thought by some Anatomists to consist of concrete blood or a *parenchyma*: by others, of a peculiar carnous substance; by others, that it is of a double nature (because of its different colour;) the outer part, which is of a dull red, to be a peculiar *parenchyma* like that of the Liver; and the inner, which looks paler, to be carnous, but fibrous. But howsoever their *substance* may appear to the naked eye, *Malpighius* with his Microscope hath discovered it to be far other than it has hitherto been apprehended. He says (*lib. de Renibus cap. 1, 2, 3.*)

"That the Kidneys in Men are not of one continued frame, but consist of several Globules, as so many distinct Kidneys: That though in grown Men their Superficies seems commonly plain, yet it is unequal in Infants new-born; and that in adult persons the conjunction of Globules does still appear within from the diversity of colour, which in the several Globules outwardly and towards their sides, where by they joyn one to another, is red, but more pale towards their middle. Each Globule consists of alike parts, namely of all those which the whole Kidney partakes of, viz. of Blood-vessels, Nerves, Glands, excretory Vessels, and a *Papilla* in which the excretory vessels terminate."

"nate.——If one take off the Membrane from
 "a fresh and as yet soft Kidney, there may by a
 "good Microscope be discovered certain round
 "and very short Bodies roll'd about like little
 "Worms, not unlike those that are found in the
 "substance of the Testicles being cut through
 "the middle, or on their surface when their co-
 "verings are removed: The way to discover
 "them is to pour Ink upon them, and then
 "gently wipe it off; by the help whereof one
 "may also discern, under the outmost surface,
 "wonderful branchings of vessels with their Glo-
 "bules (or Glands) hanging at them, like Ap-
 "ples. But for this purpose 'tis best to inject
 "Ink by the Emulgent Artery; for thereby all
 "the branches of the Artery will be tinged black,
 "and so much of these Glandules as the capil-
 "lary Arteries run through. Hereby one may
 "also discover certain continued winding spaces
 "and *sinus's* running through all the outward
 "Superficies of the Kidneys. Then cut the Kid-
 "ney in at the back lengthways as deep as to the
 "*Pelvis*, and pour Ink upon it, which gently
 "wipe off with your fingers end, and you will
 "see innumerable small pipes running from the
 "surface towards the *Pelvis* as their centre,
 "which look something like fibrous or parenchy-
 "matous flesh, but are indeed membranous and
 "hollow; which pipes make up a great part of
 "the substance of the Kidneys, and are the ex-
 "cretory Vessels of the Urine. But if you would
 "plainly discover these *tubuli*, you must have a
 "special care (in cutting of the Kidney in two)
 "that you cut streightways of them, and not
 "sloping, for then you cut them in two, and so
 "cannot trace them in their progress. From
 "the Glands into which the extremities of the

"Arteries end, the roots of the Veins arise, and
 "he thinks that the Nerves reach to them too;
 "and that it is probable that the excretory ves-
 "sels of the Urine are extended so far also, seeing
 "this is constant in all Glands, that every little
 "Globule has besides the Artery and Vein, a
 "proper excretory Vessel, as the Biliary in the
 "Liver, &c. And he has observed that those
 "same Pipes or Urinary Fibres running straight
 "from the Glands towards the *Pelvis*, do many
 "of them terminate into one of the *Papilla*,
 "through which the Urine is transcolated into
 "the *Pelvis*, for into it they jet out.] (These
Papilla shall be described by and by.) By this
 curious and accurate description of their sub-
 stance, he has greatly dispelled that mist of ig-
 norance that Anatomists hitherto were in con-
 cerning it. But to proceed.

Emulgents. The *Emulgent Artery*, springing from the de-
 scending Trunk of the *Aorta*, enters the Kidney
 in its inner and hollow side, being first divided
 into two; but having entered it, these are subdivi-
 ded into divers branches, which spreading
 themselves between the coats of the *Pelvis*, shoot
 forth into smaller twigs; and these with the like
 twigs of the Veins borrowing a common *capsula*
 from thence, (according to *Bellini*, as was obser-
 ved before) run through the whole substance of
 the Kidney, and end in the Glands afore-menti-
 oned. By this Artery (being large) is much
 blood conveyed to the Reins, partly to nourish
 them, but chiefly that in their Glandules a good
 part of the *Serum* may be separated from it, which
 being carried by the Urinary fibres or pipes to
 the *Papilla* oozes through them into the *Pelvis*.

2. *Veins.* The *Emulgent Vein* is a little larger than the
 Artery. It has the like branching within the Kid-
 ney

ney as the Artery; and its trunk coming out hard by where the Artery enters, opens into the *Cava*, into which it discharges the Blood remaining from the nourishment of the Kidney, now freed from a good quantity of *Serum* in the Glands. For that there passes nothing by this Vein to the Kidney is plain, as from the general office of Veins, which always carry from the part where their Capillaries are spread, (excepting the *Vena portæ*, which indeed has the office of an Artery) so from that notable Valve that is placed at its entrance into the *Cava*, looking towards it from the Kidney, so that the Blood may freely pass out of the Emulgent into the *Cava*, but not back again. The Emulgent Vein sometimes comes divided out of the Kidney, as the Artery goes in; but both the branches are presently united into one, and it always opens by one orifice into the *Cava*. The left Emulgent Vein is somewhat higher up than the right, according to the situation of the Kidneys themselves, of which the left stands a little higher.

Of the *Nerves* we have spoken before, discour-^{Nerves.} sing of the proper Membrane of the Kidneys; to which we need add nothing more here.

Many, particularly *Malpighius*, have endeavoured to discover *Lympheducts* in them, without^{Lympheducts.} effect: But *Casp. Bartholin* says, he can demonstrate them to the Eye, and that for the most part they run to a Gland placed below the Kidneys on the left side, where having formed a various *plexus* of Vessels, they tend to the Receptacle, being filled with *lymphæ* of a reddish colour.

Within the Kidney there is a membranous^{The Pelvis} Cell or *Sinus*, called *Pelvis* or *Infundibulum*, (i. e. ^{and Pa-} the Basin or Tunnel) which is nothing but an^{pillæ.} extension

extension or dilatation of the head of the *Ureter* ; for it consists of the same Membranes and Nervous fibres with it. It has certain Appendices which run in betwixt the *papillæ* , which are extended into membranous *fimbriae* , and these parting into numerous fibres run towards, and are inserted into, the proper Coat of the Kidneys , and serve to strengthen their substance and to make it more compact, so that it is not easily violated even by the most violent motions and contortions of the Loins where the Kidneys are seated. The cavity of the *Pelvis* is not round , but branches it self out into eight or ten (*Malpighius* says, twelve) open and large Pipes. Into it does the *Serum* issue from the Urinary Siphons through the *Caruncula Papillares* or *Mammillares* , for one of these stands at the head of each of the said Pipes, (being of an equal number with them) and are like Glandules, of a fainter colour, but harder than the rest of the *Parenchyma* ; they are about as big as a Pease, flattish above , but round or bunching out on that side next the *Pelvis* ; their perforations are exceeding narrow , so that they will hardly admit the smallest hair. Each one is the centre to all the Urinary *tubuli* in one Globule of the Kidneys ; and through them does all the Urine ooze into the *Pelvis* , and none through any pores of the *Pelvis* , as some heretofore have imagined.

The action
of the
Kidneys.

The *action* of the Reins is to separate and evacuate the serous humour from the Blood , which, as was said, is brought to them together with the Blood, by the Emulgent Arteries ; which is done in this order. After the two branches of the Emulgent Artery are enter'd the Kidneys, they are presently each of them divided into four or five , and those again into many more, till at last they

they end in the smallest Capillaries, which terminate in the Glandules towards the outer Superficies, whereinto they infuse their liquor. Into the same Glandules are inserted also the Capillary veins, and the Urinary siphons, each of which imbibe thence their proper liquor. By the Veins the Blood returns into the larger branches of the Emulgent Veins, from thence into the single Trunk, and by it to the *Cava*, which conducts it to the Heart: But by the Urinary pipes does the *Serum* drill to the *Papilla* or *Caruncula*, placed at the entrance into the *Pelvis*, through which it distils into it. And this *Pelvis* being the head of the *Ureter*, the *Serum* glides readily out of it down by the *Ureter* into the Bladder.

But now it is very difficult to determine, whether this separation of the *Serum* in the Kidneys be procured by any kind of effervescency or fermentation; or whether they serve merely as a strainer, through which it is squeezed or transcolated. If it be separated only this last way, how admirable is the configuration of the Pores, that the *Serum* with all its contents should pass by them without the least drop or stain of blood, when yet often purulent matter, brought out of the *Thorax*, and thoroughly mixed with the blood, and which is far thicker than the blood it self, passes through them with the *Serum*, and not any thing of blood at the same time! That such purulent matter passes by Urine, is frequently observed; but whether it be absorbed out of the Cavity of the *Thorax* by the mouths of the Veins gaping into it, as the Ancients thought it might; or it be bred in the *Parenchyma* of the Lungs apostemating, as is more probable, 'tis not a fit place here to enquire. As neither would it signify much to give you the conjectures of some learned

Men, that because such *Pus*, and much more because Pins, Needles, an Iron Nail, &c. have passed by Urine; that therefore there must be some more direct and patent way for part of the *Serum* to be convey'd by to the Bladder; and therefore have imagined that some Lacteals have been inferred into the Bladder, as others have supposed other ways: for as far as could ever be discover'd by Anatomists, there is no footstep of any such passage, how plausible soever such an *Hypothesis* may seem. And therefore we shall say no further of it. As to the fermentation whereby some suppose the *Serum* to be separated from the Blood, those who are for it affirm that a Ferment is sent for this purpose from the *Glandula renales* (to be described presently.) But this cannot be admitted, seeing there appears no way whereby such Ferment can be communicated, as shall be further shewed by and by. And the want of such a way may serve for a Refutation of that other Opinion which supposes the Humour collected in the *Glandula renales* to perform the office of a *coagulum* or Runnet to the Blood in the Kidneys, whereby the *Serum* is separated from it like whey from milk.

Some have thought that the Kidneys, besides the separating of the *Serum*, do prepare matter for the Seed; seeing the spermatical Vessels seem to have some manner of Communication with the Renal, the left spermatick Vein arising from the left Emulgent. But seeing the spermatick Vein returns blood from the Testicles to the Emulgent, and carries nothing from this to them, this Opinion is exploded by the Circulation of the Blood. Yet however though they do not prepare Matter for Seed, yet by separating the Salts and other Recrements, they amend the disposition of the blood,

blood, so that it becomes more capable of being elaborated into Seed by the *Vasa præparantia* and *Testes*.

It is not absolutely necessary for the conservati- ^{whether}
on of Life, that *both* the Kidneys should be conti- ^{necessary}
nued in a capacity to perform these Actions, tho' ^{Parts.}
they are better performed by them jointly. For
sometimes the head of one Ureter is so plug'd up
by a stone bred in the Kidney, that not a drop of
Serum can pass by it; and otherwhiles the whole
parenchymatous (or glandulous) part is so con-
sumed by an ulcer, that no separation of the *Se-*
rum can be made by it; and yet the *Serum* is suf-
ficiently carried off by the other sound Kidney.
Yea, Dr. Ant. Nuck tells us, That after having
straitly tyed the Vessels coming unto and going
from the Spleen and one Kidney, in a Dog, he
has cut them both out; and having healed up
the wound in the side by which he performed
the Operation, the Dog has continued as well af-
ter as if nothing had ail'd him.

Above each Kidney at about half an inch di- ^{Glandula}
stance there stands a Gland, first found out and ^{renales.}
described by Bartholomæus Eustachius, by some
called *Glandula renales*; by others, *Renēs succentu-*
riati; by Bartholin, *Capsula atrabiliaria*; by Dr.
Wharton, *Glandula ad plexum nervæum sita*. Which
several Names they have had given them, from
the several Uses the Imposers have ascribed to
them.

They are commonly but two, and are placed ^{Their suc-}
over (but towards the inside of) the Kidneys, ^{ation.}
having the fat about the Kidney coming between.
The left is nearer to the Diaphragm, standing
higher than the right, but the right is nearer to
the *Vena cava*.

The

*Figure
and Sub-
stance.*

They are seldom of the shape of the Kidneys, but are of not much unlike *substance*. Their *figure* is often three-corner'd, having the shape of a Satchel with its bottom upward. Sometimes they are oval but flattish.

*Magni-
tude.*

They are bigger in Children proportionably than in Men; for in the former they are near the bigness of their Kidneys (as may be guessed by the following figure of the Kidneys and these Glands in an *Embryo*;) but they do not increase as other parts do, so that in adult Persons they are not above two inches long and one broad. Commonly the right is bigger than the left.

*Mem-
brane.*

They are covered with a thin *Membrane*, which is knit very fast to the outer or adipose Membrane of the Kidneys.

Cavity.

They have a manifest *Cavity* in their larger end, in which is contained a black and feculent Humour, that tinges the side of the Cavity. Into it there are a great many little holes gaping out of the substance of the Gland, according to Dr. *Wharton*; and it self opens into a Vein, but has a Valve placed just at the entrance, that permits the humour contained in the Cavity to flow out by the Vein, but hinders its return.

Vessels.

They have *Veins* and *Arteries* commonly from the Emulgents, sometimes from the *Cava* and *Aorta*, and sometimes from the *Vasa adiposa*. Their *Nerves* come from the stomachick branch of the Intercostals, that runs to the proper Membrane of the Kidneys and to the Spleen also. *Lacteals* they have none. *Bartholin* affirms they have *Lymphaticks*.

Use.

There have been divers conjectures of the *use* of these Glands, but none generally consented to as true. Dr. *Wharton's* guess is, that some humour is imbib'd from the Spleen by the Nerves
that

that are common to the Spleen and these Glandules (being both from one branch) and is deposited in their Cavity, which being not purely excrementitious (though perhaps unprofitable to the Nerves) is restored again to the Veins, as being of some use to the venal blood. Dr. *Glisson* also thinks they receive something from the Spleen, which being refin'd here is imbib'd again by the Nerves, by which it ascends to the Brain or Spinal marrow, and descends again by them, being either it self a *Succus nutritius*, or else a Vehicle for it. *Riolanus* thinks they are of no use at all in Men, but only in the *Fœtus* in the Womb. *Veslingius*, *Bartbolin* and many others think that they make a ferment, or *Coagulum* for the use of the Kidneys to help the separation of the *Serum* from the Blood. And this indeed were a probable use if there could be found out any way whereby ought could conveniently pass from hence to the Kidneys. But the Veins that go out of them are inserted either into the Emulgent Vein or into the *Cava*, whose Blood is flowing from the Kidneys, so that it cannot pass to them, unless one would suppose a contrary course of humours in the same Vessel, which seems absurd. And there are no other Vessels to serve this turn. *Diemerbroeck* conjectures, that their black juice is made of the Arterial Blood, and acquires a certain fermentative power necessary for the Venous Blood, into which it is received by the *Cava*, from the Veins that go out of these Glandules. But this, says he, is but a conjecture. And in truth all the other Opinions are no more, nor very probable ones neither; so that we must still acknowledge our Ignorance of their true Use.

Tab,

Tab. V.

Fig. I. Represents a Kidney cut in two lengthways, from the Back to the Pelvis.

AA *The glandulous part of the Kidney.*

BB *The Tubuli urinarii or Siphons, which convey the Urine separated by the Glands, into the Pelvis C.*

D *The mouth of the Ureter.*

Fig. II. Shews the Aspect of a Kidney cut lengthways from the Ureter to the Pelvis, from Bellini.

AAA *The Kidney dissected as is said.*

B *Half of the Ureter bent toward the right hand.*

C *The other half of the Ureter bent to the left hand.*

D *A branch of the Emulgent Vein.*

E *A branch of the Emulgent Artery.*

F *The Pelvis opened.*

GG *Some of the Papillæ through which the Urine issues into the Pelvis.*

I *The beginning of the Ureter.*

Fig. III. Representeth the Kidneys and Capsula Renales in the same proportion as they appeared in an Abortion supposed to be about five months old, communicated to me by Dr. E. Tyson.

AA *The Glandulæ Renales, which were rather bigger than the Kidneys themselves.*

BB *The*

fig. 1.

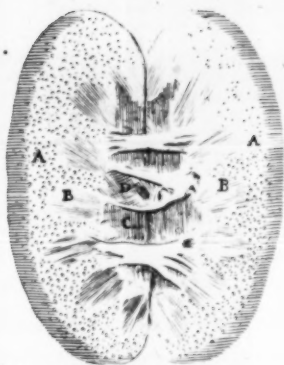


fig. 2.

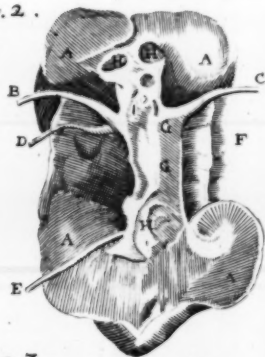
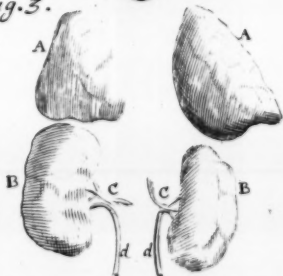


fig. 3.



The Spleen of the Same Abortion.

BB The Kidneys, whose surface is very uneven, being divided into several Bodies as a Bullock's Kidney is.

cc The Emulgent Vessels.

dd The Ureters.

C H A P. XVIII.

Of the Ureters.

THE Ureters, in Latin *Meatus urinarii*, are The Ure^a called in Greek *ὑδρηγες*, either from *ὑδρῶν, ters.* to pifs, or *ὅτι ἔχου τρεῖς*, because they keep the Urine.

They arise out of the inner Sinus or Pelvis of Their Ori-
the Kidneys, coming out on their inner or con-^{gine.}
cave side contiguous unto (but on the under side
of) the Emulgents.

There is one on each side.

Number.

They are somewhat like to Veins, but whiter, Substance
thicker, and more Nervous. They reach from the and Figure.
Kidneys to the Bladder, not in a direct line, but
something crooked like an Italick *s*. They are a
little above a span long, and as thick as a Barley-
straw naturally. But in such as have had large
Stones descend by them from the Kidneys to the
Bladder, they have sometimes become almost as
wide as a small Gut.

Their Coats are almost like those of the Sto- Coats and
mach and Guts, the inmost and outmost tendi- Vessels.
nous, and the middle carnos made up of two
ranks of Fibres. They receive small Veins and
Arteries from the neighbouring parts. As to their
Nerves, Dr. Willis saith, That after the Inter-
costals have sent forth all the Mesenterick Nerves,
each Trunk descending sends forth three or four
several

several slips that are carried into the Ureters, which makes the pain so very exquisite when some viscid matter or stone sticks in them.

*Passage and
Insertion.*

As they go out of the Kidneys they pass over the Muscles *Psoæ* (which bend the Thigh) between the two Membranes of the *Peritonæum*, and descending as abovesaid, they are inserted in the lower side of the Bladder, (near its neck) running between its two proper Coats about the length of an Inch, and continued with the inner.

*Why the In-
sertion is
oblique.*

This insertion is thus oblique, to hinder the regurgitation of the Urine, when the Bladder is either distended with Urine, or compressed in making water; for here is no Valve, as some have affirmed.

Use.

Their use is to receive the Urine separated from the Blood in the Kidneys, and to convey it into the Bladder, thence at discretion at certain times to be emptied out of the Body.

Tab. VI. shews the Liver, Kidneys, Bladder, Testicles, &c.

AAA The sinuous or hollow part of the Liver.

B The Gall-bladder.

C The Ductus biliaris.

D The Neck of the Gall-bladder.

E The Ductus communis.

F The Umbilical Vein turn'd upwards.

GG The descending Trunk of Vena cava.

HH The descending Trunk of the great Artery.

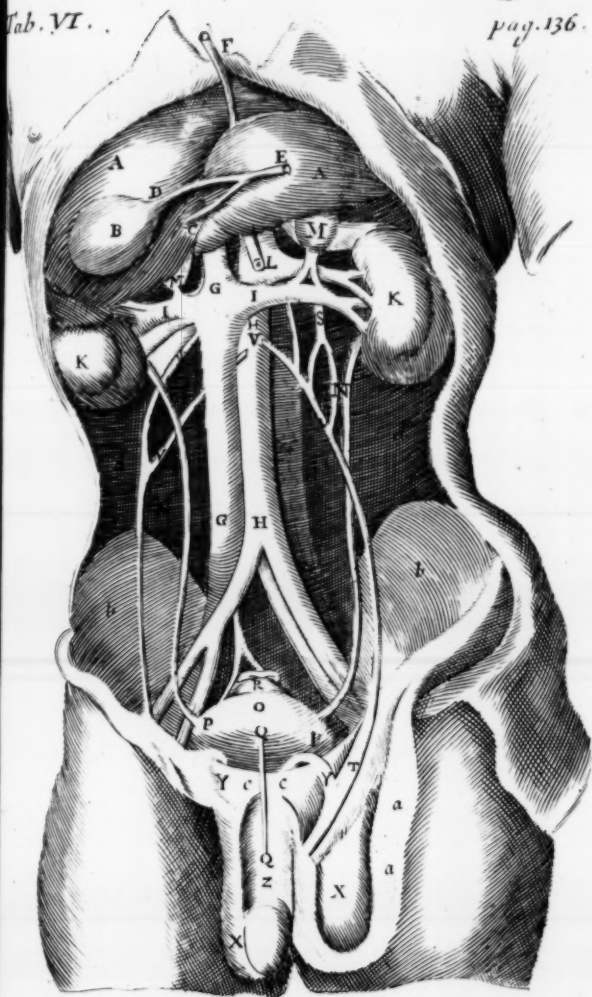
II The Emulgent Veins.

KK The Kidneys in their natural situation.

LL The Emulgent Arteries.

MM The Glandulæ Renales, with the Veins that go from them to the Emulgents.

NN The



NN The Ureters descending from the Kidneys to the Bladder.

O The bottom of the Bladder.

PP The insertion of the Ureters into its sides.

QQ A portion of the Urachus.

R A portion of the streight Gut cut off.

SS The Venæ præparantes, the right whereof springs out of the Trunk of the Cava, the left out of the Emulgent Vein.

T The Corpus pyramidale exprest on the left side.

V The rise of the Arteriæ præparantes out of the trunk of the Aorta.

uu Their reception into one common cover with the Veins.

XX The Testicles, the left whereof is divested of its common Coat.

YY The Vasa deferentia, ascending from the Testes to the Abdomen.

Z The Yard.

aa The Cod, that cover'd the left Testis, separated from it.

bb The Ossa ilia.

cc The Ossa pubis.

dd The Loins.

C H A P. XIX.

Of the Bladder.

THE Bladder is called in Latin *Vesica urinaria*, in Greek *μύσος κύστις*, from its office of receiving the Urine. The Bladder. Its name,

It is seated in the *Hypogastrium*, betwixt the two Coats of the *Peritonæum*, in that Cavity that is formed of the *Os sacrum*, *coxa* and *pubis*, and is called *Pelvis*. In Men it lies upon the *Intestinum rectum*. Seat and Connexion.

rectum ; in Women it adheres to the Neck of the Womb, which is placed betwixt the Bladder and the streight Gut : in both it is knit before to the *Ossa pubis*. Moreover it is knit to the Navel by the *Urachus*.

Its Substance is made up of three *Membranes*.

Membranes The first and outmost is borrowed from the *Peritonæum*. *Riolanus* says, this Coat is a duplication of the *Peritonæum*, within which the Bladder lies hid suspended like a Bottle turned the mouth downwards. On its outside in Man it is besmeared with fat, but not in Beasts.

The second is thicker, and endued with carnos Fibres ; yea *Aquapendens*, *Spigelius*, *Walaus*, and *Bartolin*, will have it to be a true Muscle, serving for the compression of the Bladder, to squeeze out the Urine, as the Sphincter serveth for constriction, to retain it.

The third and innermost is white and bright, of exquisite sense, as those can witness who are troubled with the Stone.

Within, it is covered with a slippery mucous humour, such as the Gall-bladder has on its inside, and such as the Intestins abound with : which without doubt must be spued out of some Glands in this inmost Coat, though they be hardly discernable. This doth defend it from the acrimony of the Urine.

Fibres.

Its Membranes have all sorts of *Fibres*. And when these Membranes and Fibres are too long or too far extended with plenty of Urine, they lose the power of contracting themselves, whence there insues a stoppage of Urine.

Persorations.

It is *perforated* in three parts, *viz.* in the Sides, where the Ureters are inserted, to let in the Urine ; and before at its neck, to let it out.

Parts, viz.

It hath two *parts*, to wit, the Bottom and the Neck.

The

The *Bottom* comprehends the upper, wider *Bottom*. and more membranous part of the Bladder, to which the *Urachus* being tyed reaches the Navel, which, together with the bordering Umbilical Arteries, becomes a strong Ligament in the adult, hindering the Bladder to press upon its neck. But as for the Arteries, *Riolanus* * affirms, That * *In animal. ad Bauh.* they contribute nothing to the suspension of the Bladder, neither reaching to the Navel in the adult, nor touching the body of the Bladder. Of the *Urachus* see after, chap. 33.

The *Neck* is lower than the bottom, and *Neck*. straiter. In Men it is longer and narrower, and being carried to the rise of the Yard opens into the *Urethra*; in Women it is shorter and wider, and is implanted into the upper side of the *Vagina* of the Womb; In both it is carnous and muscular, woven of very many Fibres; especially transverse or orbicular, which lye hid within the streight Fibres that surround the whole body of the Bladder, and these make the Sphincter, which constringes the neck of the Bladder so, as no Urine can pass out against ones will, unless when it is affected with the Palsie or other malady, by which there sometimes happens an involuntary pissing.

The Bladder is oblong and round, in *shape* like *Figure* unto a Pear.

Its *Cavity* is but one ordinarily; yet some- *Cavity*. times it has been found to have a membranous partition, that divides it into two; which yet had a hole in it for the communication of one Cavity with the other. Such a partition was observed in the Bladder of the Great *Casaubon*.

It hath *Arteries* and *Veins* from the *Hypogastri-* *Fig. 11.* *ca.*, which are inserted into the sides of its Neck,

L

where

where they are immediately branched into two, whereof one is spent upon the Neck, and the other on the bottom. *Nerves* it hath (according to Dr. *Willis*) from the lowest *Plexus* of the Intercostals in the *Abdomen*, and from the Marrow of *Os sacrum*. For the said *Plexus* sending two *Nerves* into the *Pelvis*, they have each of them a Vertebral Nerve joyned to them, and so make two new *Plexus*, from one of which there passes a Nerve, that being divided into many branches, is on each side distributed into the Bladder and its *Sphincter*.

Use.

The *use* of the Bladder is to receive the Urine from the Ureters, and to contain it, like a Chamber-pot, until the time of excretion, when it is squeezed out of it by the help partly of its own carnous Membrane, and partly of the Muscles of the *Abdomen*.

Observations.

Bartholin quotes some Observations of *Borrichius* concerning the Bladder, worthy to be noted, viz. If it be boild in acids, it turns into a Mucilage; if in salt liquors, it is thickned; if in oleous, or in the liquor of the Alkali salts of Tartar or Herbs burnt to ashes, it is neither thickned nor turns into a Mucilage, but is burnt as if it were laid on burning Coals, and may almost be crumbled to powder. By which, says he, it appears, with what great danger to the Bladder, Men inject into it either acid, salt, or oleous liquors for breaking the Stone.

C H A P. XX.

Of the Vasa præparantia in Man.

Hitherto we have handled the parts ministering to *Nutrition*, whereby the Nutrients are prepared in the lower Belly for the sustentation of an individual body, (and their Excrements separated, and discharged out of the body ;) Now we come to the Organs of *Generation*, whereby through procreation is conserved a perennity of Mankind, which Nature hath denied to particulars. These parts being not alike in both Sexes, we must necessarily treat of each apart, and first of those of Men.

In Man some of these parts afford matter for the Seed, to wit, the *Arteriæ spermaticæ*; others bring back again the Blood that is superfluous to the making of the Seed and to the nourishment of the Testicles, and these are the *Venæ spermaticæ*; and both these Arteries and Veins were formerly called *Vasa præparantia*: some make the Seed, as the Stones; some convey it from thence to its conservatory or store-house, as the *Vasa deferentia*: some contain the Seed till the time of Copulation, and these are the *Vesiculæ seminales*: some discharge the Seed into the Matrix in coition; this is done by the *Penis*: and some, lastly, moisten the passage, (*viz.* the *Urethra*) whereby the Seed issues, and those are the Prostates. Of all which in order. And first, of the

Vasa præparantia, which are said to prepare Vasa præparantia. These are of two sorts, *Arteries* and *Veins*.

Arteries.

The *Arteries* are two, and spring from the Trunk of the *Aorta*, commonly two Fingers breadth under the Emulgents, not from its side, but out of its fore-part, the right whereof climbing over the Trunk of the *Vena cava*, runs obliquely to the Vein of the same side; as also the left, marches to the Vein of that side.

Veins.

The *Veins* are also two. The right arises usually from the Trunk of the *Vena cava*, a little below the Emulgent; the left from the Emulgent it self, for otherwise it must have gone over the *Aorta*, whereby it might have been in danger of breaking; or rather by the continual pulse of the Artery, the recourse of the Venal blood might have been retarded. Now both these Veins, and Arteries a little after their rise meet, and are invested both in one Membrane made of the *Peritoneum*, and then run streight through the region of the Loins above the Muscles *Psoæ* on each side, and above the Ureters; as they go, bestowing little slips here and there upon the *Peritoneum*, between whose duplicature they descend, and so arrive at its processes. The Veins divide very often into many branches, and by and by inosculate and unite again; but the Arteries go along by one Pipe only on each side, until within three or four Fingers breadth of the Stones, where each is divided into two branches, the less whereof runs under the *Epididymis*, the larger to the Testicle. And as I said they descended betwixt the Membranes of the *Peritoneum*, so they pass into the *Scrotum* between them, not perforating them in the processes, as in Dogs and other Creatures, wherein the processes of the *Peritoneum* are hollow like a Quill; but in Man the inner Membrane of the *Peritoneum* shuts the hole, lest the Intestins fall by it into the Cod; of which

which there is greater danger in him, (and we see it often happen) because of his going upright. But to return to the *Vasa præparantia*. It has been generally taught that there are divers inosculations of the Arteries with the Veins in their passage, whereby the Venal and Arterial blood are mixed; but this Opinion is now exploded, for that, granting the circulation of the Blood, it is impossible. For the Blood in the Arteries descends towards the Testicles, and that in the Veins ascends from them, so that if these two Vessels should open one into the other, the blood in one of them must needs be driven back, or else, stagnating, distend and break the Vessels. But the truth is, the blood both for the nourishment of the Testicles and the making of Seed flows down by the Arteries only, and that in an even undivided course, without any of those windings and twirlings like the Tendrils of Vines talk'd so much of, (as the curious *de Graaf* from his own frequent inspection testifies :) And the Veins bring back from the Testicles what of the blood remains from their nourishment and making of Seed, and these indeed come out of their inmost Membrane by almost innumerable roots by which they imbibe the said blood, and are most admirably interwoven and inosculated one with another till about four or five Fingers breadth above the Testicle, which space is called *Corpus pyramidale*, *Plexus pampiniformis*, or *Varicosus*; but these Veins are so far from preparing the Seed, as that they only bring back what was superfluous from the making of it. And indeed the Arteries in Men do no more merit the name of *Præparantes* in respect to the Seed, than the Gullet in respect of the Chyle, or the *Ductus thoracicus chyliferus* in regard to the Blood; for their

blood acquires no sensible alteration till it come to the Testicles themselves. But however we continue the old names, declaring only against the reason of them. And we will only note two things more. First, That the Spermatick veins have from their rise to their end several *Valves* which open upwards, and so suffer the blood to ascend towards the *Cava*, but not to slide back again. Secondly, That though the Spermatick Arteries go such a direct course in Men, as has been said; yet in Brutes they are more complicated and twisted with the *Veins*, but without any anastomoses of one into the other.

There are *Nerves* and *Lympheducts* that accompany these *Vasa præparantia*: of which in the next Chapter.

C H A P. XXI.

Of the Stones, or Testicles, the Scrotum, and the Epididymidæ.

*The Stones.
Their
name.*

TH E *Stones* in Latin are called *Testes*, either because they *testifie* one to be a Man, or because amongst the *Romans* none was admitted to bear witness but he that had them. In Greek they are called *μῆλα*, *κῆλας*, and also *δίδυμοι*, *Twins*, because according to Nature they are always two.

*They are
principal
parts.*

They are reckoned among the principal parts, and that justly; for though they are not necessary to the life of the *Individual*, yet they are, to the conservation of the *Species*. Yea and by the loss of them the *Individual* receives very great prejudice both as to the strength and activity of his

his body, and as to the acuteness of his reason, &c. according to that of *Avenzoar*, *In Eunuchis males agnoscimus mores, rationis sunt pessimæ, — intellectus diminuti.*

They have a peculiar substance, (such as is not in all the Body besides) whitish and soft, made up of innumerable little ropes of Seed-carrying vessels, which are continued (and by very thin Membranes tyed) to one another, carrying the Seed in their undiscernable hollowness. The way to make these Vessels visible, *de Graaf* has taught us, viz. Tye fast the *Vas deferens* in a live-Dog or other Brute, and then these internal Ropes of vessels otherways inconspicuous, will, presently be so filled and distended with seminal matter, as that they may be easily discerned. *Galen*, *Dr. Wharton*, and of late *Peyerus*, &c. reckon them amongst the Glands, and that with good reason.

They are in Number two, hanging without the Abdomen, at the root of the Yard, in the Cod. Their Figure is oval, only a little flattish. Their Bigness differs very much in several Persons; as big as a Dove's Egg is reckon'd a mean size. *Hippocrates* held the right to be bigger and hotter than the left, and therefore called it *apparet*, the Male-getter, as the left *συνεχ.*, the Female-getter. But these are fancies that are obsolete, and indeed seem ridiculous, seeing there is no such difference of their bigness, and that their Vessels are common.

They have Arteries and Veins (as was said before) from those called *Vasa preparantia*. Which some have thought to reach onely to the inmost Coat called *Tunica albuginea*, because they are not conspicuous in the inner substance of the Testicles. But though this may be true of the Veins,

which onely receive the superfluous Arterial Blood, and have nothing to do with the Seed ; yet it is not true of the Arteries , namely of the most numerous branches of them. Indeed Blood is seldom seen in the substance of the Testicles, but that comes to pass by reason that the Arterial Blood presently loses its colour , and by the feminisick faculty of the Stones is turned into Seed, which being whitish, of the same colour with the Vessels, makes them undiscernible. Yet in those men that have died of languishing Diseases, and whose *Testes* have their faculty impaired, *Diemerbroeck* affirms that he has oft discover'd sanguiferous vessels in the inmost parts of the Stones, and has shew'd them to many in the publick Anatomical Theatre. As for *Nerves*, *Dr. Willis* says he could never observe more to go to them than one from a Vertebral pair, and that too was most of it spent upon the Muscle *Cremaster*. *Diemerbroeck* agrees to one Nerve, but thinks it proceeds from the sixth pair, (which is *Dr. Willis's* Intercostal, as distinguish'd from that commonly called the sixth, but his eighth.) Others will have branches from both these Nerves to go to them. Concerning the use of these Nerves there is great controversie. *Dr. Glisson*, *Wharton*, &c. will have them to convey a *Succus genitalis*, which makes the greatest part of the Seed. *Dr. Willis*, as he denies (in *Cerebri Anatomie*, cap. 27.) any *Succus nutritius* to be conveyed by the Nerves to other parts, so that any *Succus genitalis* is brought by them hither, but onely animal Spirit. And whereas to strengthen the former Opinion, 'tis usually objected, That the Seed must needs consist of a nervous Juice and plenty of spirits brought from the Brain, because of the great debility and enervation that is induced

ced upon the Brain and Nerves by the too great expence of it : he thus answers , That this comes to pass, because after great profusions of Seed, for the restauration of the same humour (whereof Nature is more sollicitous than for the benefit of the Individual) a greater tribute of spirituous liquor is required from the Blood to be bestowed on the Testicles : wherefore the Brain being defrauded of a due income and afflux of the said spirituous liquor ; languishes ; and so the animal spirits failing in the fountain, the whole Nervous system becomes depauperated and flaggy. Where-to may be added , that also the animal Spirits themselves that actuate the *Prostates*, being derived from the Spinal Marrow , are much wasted by venereal Acts ; so that for this reason besides, the Loins are enervated.] In this answer *Bartholin* acquiesces. And *de Graef*, *Dicmerbroeck*, &c. confess indeed that the spirituous Arterial Blood is impregnated with Animal Spirits from the Nerves, but affirm, that the matter out of which the Seed is elaborated, is onely the said Blood ; and to these we subscribe. *Lympheducts* they have also arising from betwixt their Coats , and ascending upwards into the *Abdomen* with the *Vasa deferentia*. These have many Valves looking upwards, which hinder any thing from descending by them to the *Testes* , but permit the *Lympha* to ascend, which they convey into the Chyliferous Vessels. *Malpighius* thinks it not improbable, that some fat is derived to the seminary Vessels, for the generation of Seed, or at least to be mixt with it ; seeing most Creatures grow the fatter upon being gell.

They have two sorts of Coats , proper and *Couts.* 3
common.

The

The Cod.

The common invest both the *Tesies*, and are two. The outermost consists of the *Cuticula* and True skin (here thinner than in other places.) This is called *Scrotum*, hanging out of the *Abdomen* like a Purse. It is soft and wrinkled, and is generally affirmed by Anatomists to be without fat. On the outside it has a Suture or Seam, that runs lengthways of the *Cod*, and divides it into the right and left side. The other or inner common Coat, is a carnosus membrane, which seems to be muscular, because of the power it has to contract and wrinkle it self. It is called *Særo*, and adheres to the proper Coat next under it (called *Vaginalis*) by many membranous Fibres.

This is the common account of this part that all Anatomists have usually given: But lately Dr. *Fred. Ruysch* affirms, "That it has the *membrana adiposa* also under the *carnosa*, or rather that the *carnosa* is fatty (on the inside) as it is in other parts of the body. And besides, he says, that in the *Scrotum* there is a *Septum* within dividing it into two parts, of which, says he, you have nothing in *Vesalius*, *Bartolin*, *Verbeyn*, *de Graef*, &c. Men that have otherwise deserved very well of Anatomy: And what wonder? seeing all things about the *Scrotum* of one newly dead are so slippery and moveable, that the true constitution of the *Septum* can hardly appear. Wherefore if any would demonstrate this, the *Scrotum* is to be blown up, and to be cut open after 'tis dried, by which means the *Septum* yields it self to view, and has an infinite of blood-vessels running through it.] Thus he.

The proper Coats are also two, and these enclose each Stone apart. The outer is called *Elytraides*,

troides, or *Vaginalis*; because it contains the Stone as a *sheath*. It is a thick and strong Membrane, having many *Veins*. In the outside it is uneven, by reason of the Fibres by which it is knit to the *Dartos*; but in the inner side it is smooth. This is nothing else but the production of the *Peritoneum*, even as the *Scrotum* is of the Skin and *membrana carnosæ* of the *Abdomen*. Into this coat is inserted the Muscle *Cremaster*, of which presently. The inmost is *ὑπό το ὑπόδοιν* the *Nervous membrane*, called *Albuginea*, from its colour. It is white, thick and strong, framed of the external Tunicle of the *Vasa preparantia*. It immediately enwraps the Stone, towards which it is rough, but on the outside next the *Vaginalis* it is smooth; and between these two the Water is contained in an *Hernia aquosa*.

Into the outer of the proper Membranes (as *Muscles*, was said) is inserted the *Muscle Cremaster*. These Muscles (to each Stone one) have their rise from the *Ossa pubis*; and almost encompassing round the processes of the *Peritoneum* descend with them to the Testicles; where their carnosus Fibres run through the whole length of this same *Tunica vaginalis*, especially in its lower part, and so keep the Stones suspended, from whence they have their name (from *ἔρεος* *suspensio*.) From their spreading themselves thus on the outside of the outer proper Coat, *Kiolanus* reckons them for a third proper Coat, calling it *Erythroides*: and because by its carnosus Fibres it makes the *vaginalis* look red, such as take it not for a distinct Coat, do give the name of *Erythroides* also to the *Vaginalis*, calling it by either name indifferently. These Muscles pull up the Stones in the act of generation, that the Vessels, being slackned, may the more readily void the Seed:
and

and at other times they help to sustain their weight.

These Muscles in sickness and old age become flabby, and so the *Scrotum* relaxing it self, the Stones hang low.

Epididymidæ.

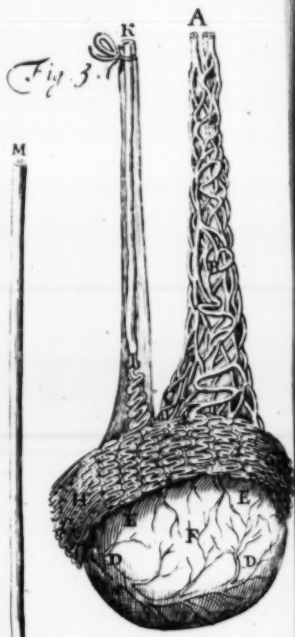
Upon the Stones as yet clad with the *Tunica albuginea*, are fixed the *Epididymidæ* (called also *Parastatae*, *Standers by*, or *Assistants*) enwrapped in the same Coat with the *Spermatick* vessels. They adhere closer to the Testicles at their ends than in the midst. *De Graef* defines them to be *Vessels making with their various windings that Body that is fix'd on the back of the Testicles*. To find out their substance, he directs us thus. "First, "take off the Membrane that encompasses them "and knits them to the Stones, and then there "will appear many windings, which with the "edge of a Knife may without hurting the Vessels be so easily separated from one another, "that they may be drawn out into a length like "a thing folded: for they are only folded from "one side to the other, and are kept in that site "by the Membrane received from the *Tunica albuginea*, (or *Spermatick vessels*.) But when "you have unravel'd half of them, you must cut "another very thin Membrane, and then you "will see other Vessels lye just like these, and "may be unloosed like them. And the whole being unravel'd, the thicker they are by how "much further from their origine, which is implanted into the upper part of the Testicle by "six or seven ramifications: which having run "so far as where they joyn into one duct, make "it as thick as a small thread; and this by degrees so thickens, that being encreas'd like a "cord it makes the *Vas deferens*, (of which in "the next Chapter.)

"So

Fig. 1.



Fig. 2.



" So that (saith he) it is clear from hence,
 " first, that the *Testes* do not differ from the
 " *Epididymidæ* (or *Parastatæ*) saving that those
 " consist of divers ducts ; but these, after their
 " six or seven roots that arise out of the Testicle
 " are united, (which they are in a short space)
 " but of one, only a little thicker. Secondly,
 " that the *Epididymidæ* differ not from the *Vasa*
 " *deferentia*, saving that the former go by a ser-
 " pentine winding passage, and these by a
 " streight, and that those are a little softer and
 " narrower. And so (concludes he) following
 " this *Ariadne's* thread we have happily made
 " our way out of the Labyrinth of the *Testes* and
 " *Epididymidæ*.

The Uses of the Stones are two :

Use.

The first is to elaborate the Seed by the semi-
 nifick faculty resident in them. For they turn a
 good part of the Blood, which is brought by the
Arteria præparantes, and impregnated with Ani-
 mal spirit, into Seed ; some is spent on their
 own nutrition ; and what remains from both, is
 carried back by the Veins called *Præparantes*.

The second is, to add heat, strength and cou-
 rage to the Body, as gelding doth manifest, by
 the which all these are impaired.

Tab. VII. shews the *Vasa præparantia*, *Testes*, *E-*
pididymidæ, *Vasa deferentia*, &c.

Figure I.

A The Artery preparing Seed, running from the
 Trunk of the Aorta to the Testicle.

B Its division into two branches.

CC The lesser branch thereof, which runs to the Epi-
 didymidæ. DD The

- DD The greater, which is implanted into the upper part of the Testicle, and descends along its back towards its lower part, to which the smaller end of the Epididymis is annexed; then it goes back again along the Belly of the Testicle, where it is divided into many branches.
- E The greater end of the Epididymis knit close to the upper part of the Testicle.
- F The middle part of the Epididymis turn'd up, that the ramifications of the Artery that run along its lower part, may be seen.
- G The smaller end of the Epididymis sticking firmly to the lower part of the Testicle.
- H The end of the Epididymis, or beginning of the Vas deferens.
- I The Vas deferens cut off, before it come to behind the Bladder.
- K The Testicle placed so as that its Vessels may best be seen.

Figure II.

- A The Vein said to prepare Seed running from the Trunk of the Vena cava to the Testicle.
- BB The branches of the Vena præparans tending to the Caul and Peritonæum.
- C The first division of it into two branches, which afterwards are wonderfully subdivided and united again.
- DDDD The Valves of the Venæ præparantes, about which the Veins being blown up appear knotty.
- EEEE Very many divisions and unions of the Venæ præparantes, that the Blood superfluous from the generation of Seed, being detained in one ramification, may return to the Heart by the other.
- F The upper part of the Testicle into which the ramifications of the Vena præparans are implanted.
- G The

- G *The ramifications of the Venæ præparantes creeping along the sides of the Testicles through their white Coat.*
H *The Body of the Testicle.*
I *The bigger end, K the middle, and L the smaller end of the Epididymis.*
M *The Vas deferens cut off almost in the middle.*

Figure III.

- A *The Preparing Vessels cut off.*
B *The Preparing Vessels as they run to the Testicles.*
C *The ramifications tending to the Epididymidæ.*
D *The greatest branch of the Arteria præparans running along the Belly of the Testicle.*
EE *The ramifications of the Venæ præparantes.*
F *A Dog's Testicle swelled with Seed.*
G *The bigger end of the Epididymis turgid with Seed.*
H *The lesser end likewise turgid with Seed.*
I *The end of the Epididymis or the beginning of the Vas deferens.*
K *The Vas deferens of a Dog tied before the Coitus, the preparing Vessels being uncut, that the Seminary Vessels being filled with Seed may be seen more apparently.*

C. H. A. P. XXII.

Of the Vasa deferentia, Vesiculæ feminales, and Prostata.

OUT of the *Epididymidæ* at their smaller end arise the two *Vasa deferentia*, otherwise called *Ejaculatoria*, as if in *Coitu* the Seed were squirted

squirted from the Stones through them; which indeed was the common Opinion till the *Vesiculæ seminales* were found out, which are now known to be the store-houses of the Seed, and not the Stones. So that the *Vasa deferentia* deserve not the name of *Ejaculatory*, except it be that part of them which reaches from the *Vesiculæ seminales* to the *prostate*, through which indeed the Seed is darted in copulation.

Their description.

They are white, hardish bodies, like a pretty large Nerve, with a Cavity not very discernible, but which may be made so, if one open one of them six or seven Fingers breadth above the Testicle, and then either blow into it with a small Pipe, or squirt some colour'd liquor into it with a Syringe towards the *Testis*, for then the vessel will be distended, and the colour will run along its Cavity towards the *Epididymide*: Or if you either blow, or squirt liquor by a Syringe the other way towards the *Vesiculæ seminales*, the said *Vesiculæ* will be distended.

Progress.

Now from the *Epididymide* these *Vasa deferentia* ascend, and pass out of the Cod into the *Abdomen* the same way by which the *Vasa preparantia* came down, viz. by the process of the *Peritoneum*. When they are entred the *Abdomen*, they are carried presently over the Ureters, and turning back again they pass to the backside of the Bladder; between which and the *Intestinum rectum* they march at a little distance the one from the other till about the Neck of the Bladder, where they grow wider and thicker: and then just as they are going to meet, their sides open into the *Vesiculæ seminales*, in which they deposit the Seed; but not terminating here, but coming close together and growing smaller and smaller,

smaller, they go on and end at the *Urethra* betwixt the *Prostate*.

These *Vesiculæ* are little Cells like those in a *Vesiculæ* Pomegranate, or something like a bunch of *seminales*. Grapes; *de Graef* compares them to the Guts of a little Bird diversly contorted. They consist of one thin Membrane, through which some small twigs of both Veins, Arteries and Nerves run. They are about three Fingers-breadth long, and one broad; but in some places broader and some narrower, as they run in and out. They are two, (one for each *Vas deferens*) divided from one another by a little interstice; and they do severally by a peculiar passage emit the Seed contained in them into the *Urethra*. They are very anfractuous and winding, and (as was said) consist of many little Cells, that they should not pour out all the Seed contained in them, in one act of Copulation, but might retain it for several. They have no communication one with another, not even in their very opening into the *Urethra*; but the Seed that is brought to the *Vesicula seminales* on the right side by the right *vas deferens*, issues by its proper passage into the *Urethra*; and that which is brought to the left likewise. So that if by any accident the *Vesicula* on one side be burst or cut, (as in cutting for the Stone they generally are) yet those on the other being intire may still suffice for generation. Now when the Seed is emitted out of these *Vesicula* in the act of generation, it passes out the same way it came in; which in this case may easily be, (though otherwise it be unusual there should be a contrary motion in the same vessel) for as it comes in from the *vasa deferentia*, it drills along gently without any force; but in *Coitu* when the Mu-

scles of the Yard and all the bordering parts are much tumified, it is expressed or squirted out of them with some *violence*, and passing along their neck, (which is a continuation of the *vasa deferentia*) ouzes through a Caruncle (like Quick-silver through Leather) into the *Urethra*, or the Duct of the Yard that is common both to Seed and Urine. I say it ouzes from the necks of the *vesiculæ* through a Caruncle into the *Urethra*, for there is one plac'd as a valve before the orifice of each of them; partly to hinder the coming of the Urine intothem, partly to hinder the involuntary effusion of the Seed.

Now though naturally the little holes through which the Seed passeth out of the necks of the *vesiculæ* into the *Urethra* be almost imperceptible; yet if they be either eroded by the acrimony of the Seed (such acrimony as is contracted by impure embraces, or in Claps as we call them) or if of themselves they be debilitated and so become more lax, (as sometimes happens to old or impotent Men that meddle too much) then there happens a *Gonorrhœa* or continual efflux of Seed. And so *Vesalius* and *Spigelius* have observed them much dilated, in dissecting such as have died with a *Gonorrhœa* upon them.

Prostatæ. The *Prostatæ* are placed near to the *vesiculæ seminales*; *de Graef* calls them *Corpus glandosum*, supposing them to be one body, and only divided by the common Ducts of the *vesiculæ seminales* and *vasa deferentia* coming through the midst of it. They are of a white, spongy and glandulous substance, about as big as a small Walnut, encompass'd with a strong and fibrous Membrane from the Bladder, to the beginning of whose neck they are joyned at the root of the Yard. In shape

shape they come nearer to an oval, save that on their upper and lower part they are a little depressed, and in that end by which the *vasa deferentia* enter, they are something hollow like a Tunnel. The Sphincter muscle of the Bladder encompasses them, so that for so far as they cover the neck of the Bladder, the Sphincter touches it not, they coming between. They have all sorts of Vessels, which run mostly on their outer side. In their inner part they have ten or more small Ducts which all unload themselves into the Urethra by the sides of the great Caruncle (through which the Seed passes from the *vesicula* into the Urethra) but themselves have each one a small one to stop its orifice, lest the liquor that is contained in the Prostates should continually flow out, or the Urine should flow in. And these small Ducts I suppose are continued from those *vesiculae* which appear in the Prostates of those that die (any way) suddenly after having had to do with a Female. For in such, the spongy part of the *Prostate* is very turgid with a ferous liquor, and in their inner part may be found these same *vesiculae*, like to *Hydatides*, which if you press upon, they will discharge themselves into the abovesaid Ducts.

What the liquor they contain should be, or *Their use* what is their use, there is great variety of Opinions. Some think that the Seed that flows from the Testicles, is further elaborated here. But that cannot be; for that the *vasa deferentia* deposite nothing in them, but all into the *vesiculae feminales*. Others think that from the blood there is separated in them an acrimonious and ferous humour, which serves for titillation or causing the greater pleasure in Venerie. As to this, *de Graef* appeals to the taste of it, which has

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nothing of acrimony. Dr. *Wharton* thinks they make a particular kind of Seed, as the Testicles do another, and the *vesiculæ seminales* a third. That these last make a Seed different from that made in the Testicles is grounded on a mistake in Anatomy, viz. that the *vasa deferentia* have no communication with the *vesiculæ*, whereas they apparently open into them, and deposite in them all the Seed they contain. That the *Prostate* make a peculiar sort, he endeavours to prove, because gelded Animals emit some Seed. But that is but precarious; for though they emit something, 'tis not necessary it should be any true Seed. Or if it be, it may well be supposed to proceed from the *Vesiculæ seminales* that have been full when the Animal was gelt. For, for this reason it has been observed that presently after gelding they have sometimes got the Female with young, but not afterwards when that stock was spent. *Bartholin* with many others thinks they make an oily, slippery, and fat humour, which is pressed out, as there is need, to besmear the *Urethra*, whereby to defend it from the acrimony of the Seed and Urine, and lest it should dry up. This Humour *Malpighius* thinks to be conveyed hither by *Ductus adiposi*; and quotes *Severinus*, affirming that he has observed a plain vessel in the Fat of the Kidneys, tending to the Spermatick vessels. He ascribes the same use to it as *Bartholin*, &c. *Diemerbroeck* confesses that it is necessary the inside of the *Urethra* should be kept moist and slippery, but thinks that that is done here as in the Bladder, Intestins and many other places, namely from some mucid part of the nourishment of the *Urethra* it self; and concludes that the *Vasa deferentia* deposite not all the Seed into the *vesiculæ seminales*, but carry

a smaller part to these *Prostate*. *De Graef* denies that the *Vasa deferentia* convey any thing to them, or have any communication with them; and therefore believes, that the Humour that is separated in the *Corpus glandosum* (as he calls the *Prostate*) serves for a *Menstruum* or Vehicle of the Seed, which flowing but in small quantity through small pores into the *Urethra*, it was necessary that this Humour should be mixt with it, that it might better reach the Womb. Whatever this Humour be, it is squeezed out partly by the intumescence and erection of the *Penis*, and partly by the compression of the Sphincter of the Bladder that girds the *Prostate* about.

These Prostates are often (at least partly) the seat of the *Gonorrhœa*; and the humour that they contain, that which is shed; for, if it were true Seed, men could never endure a *Gonorrhœa* so long without more notable weakning and emaciating, the flux being so large as sometimes it is.

I shall here omit all Philosophical Enquiries into the nature of the Seed, contenting my self purely with the Anatomical part. How far it contributes to the generation or formation of the *Fœtus*, shall be shewn afterwards, chap. 30. of a *Conception*.

The distance betwixt the root of the *Cod* and *Perineum*.
the *Podex* is called *Perineum*, ἀπὸ τοῦ περι, circumfluo, um.
because it is generally moist with sweat. By *Why these*
the Latins it is named *Interfemineum*, because it *parts in*
is placed *inter femora*, between the Thighs. *men are*
hairy.
ripe or grown persons this part, the *Pubes*, *Scrotum* and the circuit of the *Podex* are clad with hair, which serves as a veil to cover these obscene parts.

C H A P. XXIII.

Of the Tard.

The Tard. **T**HE Seed being elaborated and treasured up in the aforesaid Organs, there was need of a peculiar Instrument whereby it might be conveyed into the Womb of the Female; and to this purpose Nature has furnished the Male with a *Tard*, which we come now to anatomize.

Its name. It is called in Latin *Penis*, à *pendendo*, because it hangeth without the Belly. Also *Virga*, *Membrum virile*, *Veretrum*, *Mentula*, and by many other names invented by lustful persons and lascivious Poets.

Description. It is an Organical part, long and round, yet somewhat flat on the upper side, seated under the *Ossa pubis*; appointed partly for making of water, but principally for conveying the Seed into the Matrix.

Magnitude. As to its thickness or length it differs much in divers Men. But it is generally observed to be larger in short Men, and such as are not much given to Venery; also in those that have high and long Noses, and that are stupid and half witted.

Substance. It is neither bony, as in a Dog, Fox, Wolf; nor gristly nor fleshy; but is framed of a peculiar substance, such as might most conveniently admit of distention and relaxation.

Parts. The parts of it are either *common*, or *proper*. The *common* are three, the Cuticle, the Skin, and the *Membrana carnosæ*, which we shall not need to describe.

It

It hath no fat, for first that would have hindered its erection into that stiffness that is necessary; and secondly would have occasion'd it to grow too bulky; and lastly would have dull'd that great pleasure that in Venery the Male is affected with in this part. why it hath no fat.

The proper parts are these: the two Nervous bodies, the *Septum*, the *Urethra*, four Muscles, the *Glans*, the *Præputium*, two Ligaments, four Muscles, and the Vessels.

The Nervous bodies (called by Mr. Comper, *corpora cavernosa*) are two oblong *capsulæ* or Cases, encompassed with a thick, white, nervous, and very firm Membrane, (like an Artery) but their inner substance is spongy, being mostly a texture of Veins, Arteries and Nervous fibres, woven one with another like a Net. The nervous bodies

They spring from the lower side of the *Ossa pubis* at distinct originals, where they appear like two horns, (called by some *crura*) or are of a figure resembling the Letter Y, that the *Urethra* may have room to pass between them. When they leave the *Ossa pubis* they are each covered with a several Membrane, and are afterwards joyned together with only the *Septum* between, which the nearer it comes towards the *Glans*, is the thinner, so that before it come to the middle of the *Penis* its Fibres extend towards the back of the Yard from the *Urethra* in order like a Weaver's Slay, and while it still goes further, its Fibres by degrees grow so very small, that near the *Glans* the *Septum* is almost obliterated, and the two Nervous bodies seem to grow into one. Whence it is that the *Penis* is equally erected; for if the *Septum* had exactly distinguish'd one part from the other, it might sometimes have so hapned by the compression or obstruction of the Arteries of the

one or the other side, that one part of it would have been extended, and the other remained flaccid.

Dr. *Wharton* affirms, these Nervous bodies have Glandulous flesh within them, which keeps the Yard something plump even when it is not erect. But *de Graef* denies this, and demonstrates, that they have no other substance than before said, thus. Let the Yard be prepared thus: First gently squeeze the blood out of it, which it always has in greater or lesser plenty, and then put a little Tube into the spongy substance, namely in at that end that is next to the *Os pubis*; and let the Cavity of the *Penis* be half fill'd with water by the help of a Syringe, and shake the *Penis* with the water in it: pour out that bloody water, and fill it again with clear, and so three or four times till the water is no longer stain'd with blood. Then betwixt two linnen clothes squeeze out what water is in the Nervous bodies, and at length blow up the *Penis* so long till it have its natural bigness; in which posture if you will keep it, you must tie it hard. When the *Penis* is thus distended and dried, you may examine it as you please, and will find no other substance than was mentioned. *Diemerbroeck* says, that their substance is not a mere texture of Vessels, but is fibrous, fungous and cavernous, (such as is the substance of the Lungs) receiving in their hollow Interstices Blood and Spirits out of the Vessels that are dispersed through their substance.

Mr. *Comper* (after *Columbus*) says, there is great analogy between the internal structure of this and that of the Spleen: in both which the Veins have large apertures or cells, which most plainly appear in the *bulbus* of a Dog's *penis*, as he calls the upper part of the *Urethra* that lies between the *crura* of the Nervous bodies.

Below

Below these Nervous bodies lies the *Urethra*, ^{The Urethra.} being of a much like substance to them, saving that its spongy part, which is outer and lower, hath less pores because of its smaller and more plentiful Fibres. This part does tumefie whenever the Nervous bodies do. Its inner part is membranous, round and hollow, and exceeding sensible. It is of an equal width from one end to the other, save in its fore-part, where the *Glans* is joyned to the Nervous bodies, for there it hath a small Cavern, into which the acrimonious Urine lighting in the Stone of the Bladder, while it wheels about in it, causeth pain, and is a great sign of the Stone. Sometimes also the acrimonious eroding liquor in a *Gonorrhœa* staying here, doth cause a most tormenting ulceration.

It is continuous to the neck of the Bladder, but has not its rise from it, nor is of the same kind of substance. If you boil the Bladder and it, it will easily separate, and appears of a clear other substance and colour. It begins at the neck of the Bladder and reaches to the end of the *Glans*, which it seems to bestow a Membrane upon from its own inner one, for it is plainly continued from it.

Its Use is to convey along the Seed and Urine. ^{Its use.} And to that end there open into it small pores that transmit the Seed into it from the Necks of the *Vesiculæ seminales*, (of which in the foregoing Chapter;) and also the neck of the *Vesica Urinaria* which pours out the Urine into it.

The *Muscles* are two on each side, and so four ^{Muscles.} in all. Of these one pair are called by some, Collateral Muscles, by others *Erectores*. These are shorter and thicker, and spring from the *appendix* or external knob of the *Coxendix*, under the begin-

beginning of the Nervous bodies, and are inserted into their thick investing membrane, a little from their beginning. These serve for erection of the *Penis*.

The second pair is longer and smaller, proceeding from the Sphincter of the *Anus*. These pass straight by the sides of the *Urethra*, and are inserted into it about its middle; they serve to dilate it for miction and ejaculation of the Seed, and are called *Dilatantes*, wideners, and *Acceleratores*, hastners.

These have been generally held to be the uses of these Muscles, but *de Graef* (as also *Swammerdam*, *not. in prodr. p. 35.*) assigns a clear contrary use to them, and that with great shew of reason. For seeing the action of a Muscle is contraction, how should the former pair extend the *Penis*, and not rather draw it back towards their original? Or how should the latter serve to dilate the *Urethra*, and not rather straiten it, seeing in the action or contraction of a Muscle its Belly or Middle swells? Therefore he says, that the Muscles only contribute thus far or in this respect to the extension or erection of the *Penis*, inasmuch as by their swelling (partly by blood and spirit flowing into them, partly by their proper action) they serve to straiten and compress the roots of the Nervous bodies and the spongy part of the *Urethra*, and so drive the blood that flows in by the Arteries towards the *Glans*, and hinder its returning back again by the Veins: a resemblance whereof may be exhibited by a piece of a Gut, which if we fill with wind or water, and then compress that end by which they enter'd, (the other being ty'd) we shall see the other strut out and be more distended.

Mr. Cowper

Mr. *Comper* will not have the intumescence of the bellies of these Muscles to be the principal cause of erection; but explains it thus: The *penis* is approximated (he says) to the *ossa pubis* when these Muscles act, by means of the *Ligamentum suspensorium* (by and by to be described) whereby the blood is not only driven forwards towards the *Glans* in greater plenty, and its Veins distended, but their great Trunks running over the *dorsum penis* are compressed under the *ligamentum transversum* of the *ossa pubis*. The like cannot happen in the cavernous body of the *Urethra*, since there is no bone whose position can have that effect upon its Veins, as the *ossa pubis* have upon the *penis* it self. Wherefore the *Musculi acceleratores* compressing its veins do that office. Whence it happens, in an imperfect erection the *Glans* is not equally extended with the *penis* it self, and at other times is soonest relax.—The blood thus hinder'd in its return distends the *corpora nervosa* and *Urethra*, which are thereby erected. See his *append. ad myotom. reformat.* p. 241, 242.

The end or head of the *Penis* is called *Glans*, *Glans*. and *Balanus*. Into this the Nervous bodies terminate; and being a little thicker (on that side next them) than they, it forms a kind of a circle. On its fore-part it is smaller and sharper. It has a peculiar substance (Dr. *Wharton* says glandulous) soft and spongy, and being covered with a very thin Membrane produced from the internal one of the *Urethra* (which coming out of its hollow, dilates it self so as to cover all the *Glans*) it thereby, and from its proper substance much interwoven with Nerves, becomes most exquisitely sensible, and is the principal seat of pleasure in copulation. Which if it had not been very great, who would have taken delight in so brutish

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filth a thing as Venery? as *Andreas Laurentius* elegantly expostulates, (*Anat. lib. 7. cap. 1. q. 7.*)
 "Who (most strange!) would have solicited
 "or accepted of so vile and filthy a thing as lying
 "with a Woman? With what face would Man,
 "that divine Animal, full of reason and counsel,
 "have handled the obscene parts of Women polluted
 "with so much filth, which is discharged
 "into this low place as into the common sink of
 "the Body? On the other side, what Woman
 "would have accepted of the embraces of a Man,
 "considering the toil and tediousness of going
 "nine months with Child, the most painful and
 "often fatal bearing of it, and its Education full
 "of care and anxiety, unless the Genitals had
 "been affected in the act of coition with transporting
 "pleasure?

Some take the *Glans* to be only a continuation of the *corpora nervosa*, and not of a substance distinct from them.

Præputium.

The *Glans* is covered with the *Præputium*, or Fore-skin, which is framed of the reduplication of the Skin.

It is called *Præputium*, because it is placed *præpudendo* before the Yard: or rather *à præputando* from being cut off, for this is that which the Jews cut off in Circumcision, from whence they are called *Apellæ* and *Recutiti*. And it is reported by divers persons from their own inspection, that in Jewish Children it is six times as large as in Christians, and hangs a great way over the *Glans*, before it be cut off.

its glandula odorif.

In that part where the Prepuce is contiguous to the *Glans*, Dr. *Tyson* (as reported by Mr. *Cowper*) has discovered certain small Glands; which from the great scent their separated liquor emits, he calls *glandulae odoriferae*. They are very

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ry conspicuous in most Quadrupeds, particularly in Dogs and Boars, in the latter of which their separated liquor is contained in a proper Cyst, at the verge of the prepuce, out of which there is a large aperture, whereby 'tis remitted again to lubricate the *penis*.

The Præpuce is tyed to the lower side of the *Glans* by a *Ligament*, called *frænum*, the Bridle. This in some is so short, that 'tis necessary to cut it, to procure a compleat erection.

Besides this *Ligament*, I cannot but mention another, first (I think) observed by the ingenious Mr. *Comper*, which (from its use) he calls *Ligamentum suspensorium*. It arises, he says, from the fore-part of the *ossa pubis*, and is fixt to the *dorsum penis* on each side the great Vein that runs along it.

Of the *Vessels*, some are *cutaneous*, some pass to the inner parts of the *Penis*.

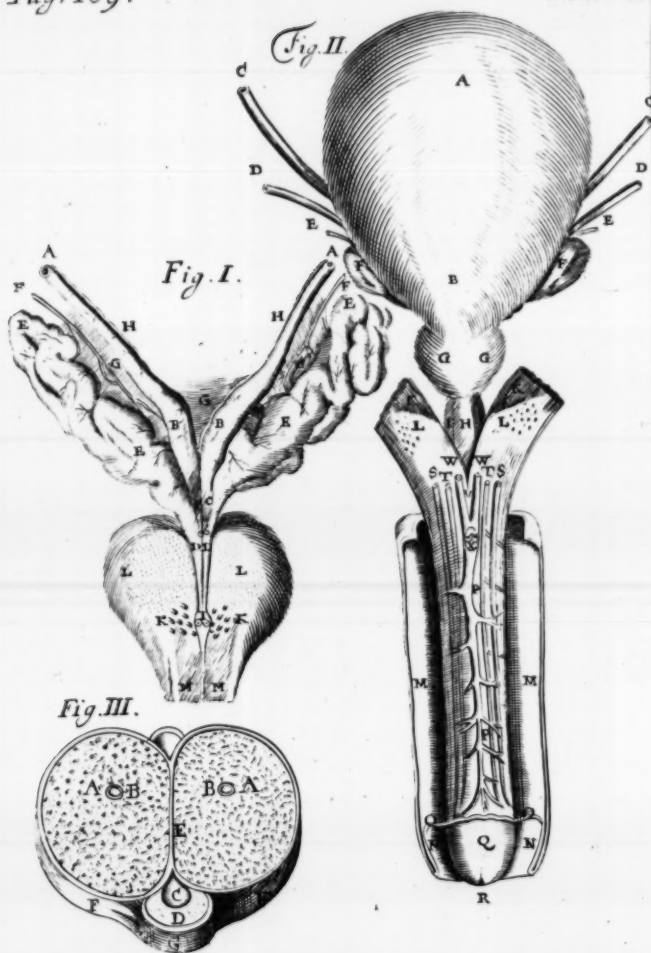
The *cutaneous Arteries* arise from the external branch of the *Iliack*, and running from the root of the yard towards and along its back, divide themselves into many branches. They are called *pudende*, from the parts they minister to; as are also the *Veins*, which spring from the exterior *Iliack*, and keep the same course with the *Arteries*. The *Veins* and *Arteries* that are bestowed on the inner parts of the *penis*, spring from the inner (hypogastrick) branch of the *Iliack*, and after they have sent some twigs to the Muscles of the *penis* and *anus*, they enter the *penis* just at the meeting of the two Nervous bodies, through whose length they run, and are mostly dispersed in them, and in the fungous part of the *Urethra*, sending forth little twigs at the sides.

It has two *Nerves* from the lowest *Vertebral*. The greater of them, that is very large and long,
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is distributed into the Nervous bodies, *Urethra*, and *Glans* ; the lesser is bestowed upon its Muscles. Concerning which Dr. *Willis* thus discour-
 ses. " This Member (saith he) having only
 " Nerves from the Spinal marrow, should only
 " have a spontaneous motion according to our
 " Hypothesis, (*viz.* that the Nerves from the
 " Brain serve for natural, and the Vertebral for
 " voluntary motion.) And yet through the tur-
 " gescency of the Genital humour, it is often
 " erected and filled with Spirit against one's
 " mind ; which is from hence, because from this
 " Vertebral pair, whence the Nerves of the *Penis*
 " spring, a sprig is reached forth to the Vertebral
 " pair next above it, *viz.* to that in which is
 " radicated the *Plexus* that is placed in the *Pelvis*
 " and bestows Nerves on the *Prostata*, into which
 " *Plexus* also a notable Nerve is implanted from
 " the Intercostal pair. Seeing therefore there is
 " a communication between the *Prostata* ; (which
 " depend much on the Intercostal Nerves) and
 " the *Penis* it self, (by reason of the insertion of
 " the foresaid sprig into the *Plexus* from whence
 " the *Prostata* have their Nerves :) hence it
 " comes to pass that it acts accordingly as they
 " are affected. But they (*viz.* the *Prostates*) are
 " not only apt to be moved by the turgescency
 " of the Seed ; but, by the communication of the
 " Intercostal Nerve, according to the impres-
 " sions made on the Senses or Brain, are wont to
 " be irritated by too importune an action ; into
 " consent wherewith the *Penis* is presently ex-
 " cited.

Lympha-
ducts.

Mr. *Cowper* has observed *Lympheducts* in this part, running under the common integuments, accompanying the cutaneous Veins, and emptying themselves into the *glandulae inguinales*. " Which, says



sayes he, " may serve to inform us, how the " morbid matter comes to be conveyed more particularly to those Glands in Venereal Cases, and " cause those Tumours that frequently happen on " that occasion, commonly called *Bubo's*. See his before-cited Book p. 227.

Its principal use is to convey the Seed into the use, Uterus of the Female; and its use to piss withal, is but secondary, for many Creatures (as Fowls in general) make no water by it, yet have a Penis for the use above said.

That part that is next above it towards the Pubes and Belly, is called the Pubes; and its lateral parts are Inguina, called Inguina, the Groins.

Tab. VIII.

Fig. I. shews the *Vasa deferentia*, Seed-bladders, and Prostates.

AA Parts of the *Vasa deferentia*, which appear thick, but have only a small Cavity.

BB The parts of the *Vasa deferentia* of a thin substance and large Cavity, being widened.

CC The extremities of the *Vasa deferentia* narrowed again, and gaping each with a little hole into the neck of the Seed-bladders.

DD The neck of the Seed-bladders parted from each other by a Membrane going between, so that the Seed of one side cannot be mixed with that of the other, before it come to the Urethra.

EE The *Vesiculæ seminales*, or Seed-bladders blown up, that their wonderful widenings and narrowings may be seen.

FF Vessels tending to the Seed-bladders.

GGG The Membranes whereby the Seed-bladders and *Vasa deferentia* are kept in their places.

HH The

HH *The Sanguinary vessels running by the sides of the Vasa deferentia.*

I *A Caruncle resembling a Snipe's head, through whose eyes as it were the Seed issues out into the Urethra.*

KK *The ducts of the Corpus glandosum, or Prostata opening into the Urethra by the sides of the Caruncle.*

LK *The Corpus glandosum divided.*

MM *The Urethra opened.*

Fig. II. *Shews the Bladder, &c. the Penis and its Vessels, &c.*

A *The upper or fore-part of the Bladder.*

B *The neck of the Bladder.*

CC *Portions of the Ureters.*

DD *Portions of the Vasa deferentia.*

EE *The Vessels running to the Seed-bladders.*

FF *The Vesiculæ seminales, or Seed-bladders.*

GG *The fore-part of the Prostata, or Corpus glandosum.*

H *The Urethra adjoyning to its spongy part.*

KK *The Muscles called the Erectors or Extenders of the Penis.*

LL *The beginnings of the Nervous bodies separated from the Ossa pubis, which puff up like Bellows when the Yard is erected.*

MM *The Skin of the Penis drawn aside.*

NN *The duplicature of the Skin making the Præputium.*

OO *The Skin that was fasten'd behind the Gland.*

PP *The back of the Penis.*

Q *The Glans.*

R *The urinary passage whereby the Glans is perforated in its fore-part.*

SS *The Nerves running along the back of the Penis.*

TT *The*

- TT *The Arteries running along the back of the Penis.*
 U *The Nervous bodies meeting together.*
 WW *Two Veins which unite together, and run along the back of the Penis in a remarkable branch.*
 X *The Vein opened, that the Valves in it may be seen.*

Fig. III. shews the *Penis* cut asunder transversly.

- AA *The spongy or fibrous substance of the Nervous bodies.*
 BB *The two Arteries that march along the Nervous bodies.*
 C *The urinary passage of the Urethra.*
 D *The spongy substance of the Urethra.*
 E *The Septum between the two Nervous bodies.*
 FF *A very strong Membrane of the Nervous bodies.*
 G *A very thin Membrane containing the spongy substance of the Urethra.*
 H *A notable Vein creeping along the back of the Penis.*

Of the GENITALS in Women.

C H A P. XXIV.

Of the Vasa præparantia.

HAVING now done with the Parts ministering to Generation in *Men*, we next proceed to those of *Women*; in describing of which it has been the method of divers Anatomists to begin first with the outer parts of the Fertility: but because we would observe, as much as may be, the same order in *Women* as we have in *Men*, we shall first begin with the Spermatick Vessels, which are of two sorts, *Arteries* and *Veins*.

N

The

*Spermatick
Arteries.*

The *Arteries* are two, as in Men. They spring from the great Artery a little below the Emulgent (very rarely either of them from the Emulgent it self) and pass down towards the *Testes* not by such a direct course as in Men, but with much twirling and winding amongst the Veins, with which yet they have no inosculation, as has been generally taught. But for all their winding, when they are stretch'd out to their full length, they are not so long as those of Men; because in them they descend out of the *Abdomen* into the *Scrotum*, but in Women they have a far shorter passage, reaching only to the *Testes* and Womb within the *Abdomen*.

Veins.

The *Veins* are also two, arising, as in Men, the right from the Trunk of the *Cava*, a little below the Emulgent, the left from the Emulgent it self. In their descent they have no more windings than in Men, and therefore are considerably shorter.

Both the *Arteries* and *Veins* as they pass down are cover'd with one common Coat from the *Peritonaum*; and near the *Testes* they are divided into two branches, the upper whereof is implanted into the Testicle by a triple root; and the other is subdivided below the *Testes* into three twigs, one of which goes to the bottom of the Womb, another to the *Tuba* and round Ligament, the third creeping by the sides of the Womb under its common Membrane, ends in its neck, where it is interwoven with the Hypogastrick Vessels like a Net. By this way it is that the *Menstrua* sometimes flow in Women with Child for the first Months, and not out of the inner Cavity of the *Uterus*: but yet that blood does not flow at that time so much by the Spermatick Arteries as by the Hypogastrick.

The

The *use* of these Spermatick vessels is to minister to the (generation of Seed, according to the ancient doctrine ; but) nutrition of the Eggs in the *Ovaria* or *Testes* (according to the new) the nourishment of the *Fœtus* , and of the Womb it self , and the expurgation of the *Menses* ; inasmuch as blood is conveyed by the Arteries to all those parts to which their ramifications come, in which parts they leave what is to be separated according to the Law of Nature , the remaining blood returning by the Veins.

C H A P. XXV.

Of Womens Testicles or Ovaria.

WOMEN'S *Testicles* differ much from Men's *Womens* both in their situation, figure, greatness, *Testes*. coverings, substance, and also use.

First, *their situation* is not without the Body, *Their situation* as in Men, but in the inner Cavity of the *Abdomen*. *men*, on each side two Fingers breadth distance from the bottom of the Womb ; to whose sides however they are knit by the Intervention of a strong Ligament, that has us'd to be called and accounted the *Vas deferens* ; as if the Seed were carried by it from the *Testes* to the Womb. Of which afterwards.

They are flat on the sides ; in their lower part *Figure* oval, but in their upper (where the Blood-vessels enter them) more plane. Their superficies is more rugged and unequal than in those of Men. They have no *Epididymides*, nor *Cremaster* Muscles.

Greatness. They differ in *bigness* according to age. In those newly come to maturity they are about half as big as those of Men; but in those in years they are less and harder. Preternaturally they sometimes grow to a vast bigness from Hydropical tumours, in which several quarts of serous liquor have been found to be contain'd.

Tunicle. They have but one *Membrane* that encompasses them round; but on their upper side, where the *Vasa præparantia* enter them, they are about half way involved in another Membrane that accompanies these Vessels, and springs from the *Peritonæum*.

Substance. When this cover is removed, their *substance* appears whitish, but is wholly different from the substance of Men's Testicles. For Men's (as was said above) are composed of Seminary vessels, which being continued to one another are twenty or thirty Ells long, if one could draw them out at length without breaking: But Women's do principally consist of a great many Membranes and small Fibres loosely united to one another, amongst which (in the outer superficies of the *Testes*) there are several little Bladders (like to *Hydatides*) full of a clear liquor, through whose Membranes the Nerves and *Vasa præparantia* run, and are obliterated in them.

Whether they elaborate Seed. The liquor contained in these Bladders had always been supposed by the followers of *Hippocrates* and *Galen*, to be Seed stored up in them, as if they supplied the place of the *Vesicula seminales* in Men. But from Dr. *Harvey* downwards, many learned Physicians and Anatomists (according to *Aristotle*) have denied all Seed to Women. Of which the said Dr. *Harvey* thus discourses, *De ovi materia*, *Exercit.* 34. "Some Women
"emit no such humour as is called Seed, and yet
"is

" is not conception thereby necessarily frustrated;
 " for I have known several Women (says he)
 " that have been fruitful enough without such e-
 " mission; yea, some that after they begun to
 " emit such humour, though indeed they took
 " greater pleasure in copulation, yet grew less
 " fruitful than before. There are also infinite
 " Instances of Women, who though they have
 " pleasure in coitu, yet send forth nothing, and
 " notwithstanding conceive. *Miror maxime*, adds
 he, *eos, qui emissionem hanc ad generationem necessa-*
riam putant, non animadvertisse, humorem illum
foras ejici, & circa clitoridem vulvaeque orificium ut-
plurimum profundi, raro intra vulvam, nunquam
vero intra uterum, ut cum maris spermate miscea-
tur; esseque consistentia serosum sive ichorosum, ad
modum urinae; non autem geniturae instar, lentum
atque unctuosum; ut tactu facile imotescit. Quo-
rum autem foras ejiciatur, cujus usus necessario in-
tus requiritur? Debitne humor ille, cum utero vale-
dicturus, ad limen vulvae amandari; ut majore cum
gratia ab utero retraheretur denuo?] So that
 both from the place of its emission, and from its
 consistence, he concludes that the humour emit-
 ted cannot be Seed. To strengthen which Opi-
 nion two Reasons may be added, why it cannot
 be the humour contained in these *Vesiculae*, and
 consequently that it cannot be Seed; first be-
 cause it is sent forth in greater quantity than that
 it can be supplied from them; and secondly be-
 cause the *Vesiculae* are destitute of any such pore
 or passage whereby the liquor contained in them
 might issue out; for if you press them never so
 hard, unless you burst them, there will nothing
 pass out of them.

We must therefore subscribe to that new but *They are*
 necessary opinion that supposes these little Blad- *Ovaries.*

ders to contain nothing of Seed, but that they are truly Eggs, analogous to those of Fowl and other Creatures; and that the Testicles (so called) are not truly so, nor have any such office as those of Men, but are indeed an *Ovarium*, wherein these Eggs are nourished by the Sanguinary Vessels dispersed through them, and from whence one or more (as they are fecundated by the Man's Seed) separate and are conveyed into the Womb by the *Tubæ Fallopianæ*, of which by and by.

That these *Vesiculæ* are analogous to the little Eggs in the *Ovarium* of Fowl, *de Graef* evinces by this Experiment, That if you boil them, their liquor will have the same colour, taste, and consistency with the White of Birds Eggs. And their difference in wanting Shells is of no moment; for even the Eggs of Fowls while they are in the Ovary (yea after they have descended into the *Uterus*) have no Shell: and though when they are laid, they have one, yet that is nothing essential to them, but only a fence that Nature has provided (upon their exclusion) to preserve them from external injuries while they are hatched without the body; whereas these of Women being fostered within their body, have no need of other fence than the Womb, by which they are sufficiently defended.

Having compared these *Vesiculæ* to the Eggs of Fowls, I might here follow the method of Doctor *Harvey* and *de Graef*, and describe the *Ovarium*, &c. in Hens, &c. that from thence these in Women might the better be conceived of and apprehended; but to the curious and learned Reader I shall recommend the said Authors for satisfaction, and avoiding all unnecessary and (to this Epitome) unsuitable excursion, I shall only
further

further note two things: First, that these Eggs in Women are commonly towards the number of twenty in each Testicle or *Ovarium*, of which some are far less than others. And secondly, that the Objection of the *Galenists* against the *Aristotelians*, (viz. that the *Testes* of Females must needs make Seed, because when they have been cut out, barrenness always follow'd) will be sufficiently obviated by this new *Hypothesis*, that agrees to the necessity of the Testicles so far as to affirm that the *Vesiculae* contained in them become (when they are impregnated by the masculine Seed) the very Conceptions themselves, which therefore it would be in vain to expect if the Female were castrated.

Besides the *Vasa preparantia*, and *Nerves* (of which last in the 27th Chapter) they have also *Lympheducts*, according to Dr. *Wharton*.

C H A P. XXVI.

Of the Vasa deferentia in Women, or their Oviducts.

Galen with most of the Ancients reckoned those short procellies that go streight from the *Testes* to the bottom of the Womb, to be *Vasa deferentia*; and that the Seed was emitted from the *Testes* through them into the *Fundus uteri*. And *Fernelius*, *Riolanus*, &c. thought they found a small Pipe passing on each side out of these procellies by the sides of the Womb to its neck, into which they were inserted and opened near its Orifice. By the former it was supposed Women not with Child did emit their Seed into the bot-

tom of the Womb, and by these latter such as were already impregnated: for that, if it should have issued into the *Fundus* where the Conception was, it would there have corrupted to the great prejudice of the *Fœtus*.

But as to these latter Ducts, *Veslingius*, *Diemerbroeck*, *de Graef*, and many other accurate Anatomists, have not been able to find the least footstep of them. And as for the former, seeing they are not pervious, nor have any Cavity, (and therefore can neither contain nor convey any thing of Seed) we must conclude with *de Graef*, that they are only Ligaments of the Testicles to keep them in their place; which he evinces further by observing that they come not to the inner Cavity of the *Uterus*, but are knit only to its outer Coat: for he says, there are only two holes in the *Fundus uteri* that admit a Probe, and those lead to the *Tubæ Fallopianæ* and not to these Ligaments.

Tubæ Fallopianæ.

Seeing therefore that those which have been accounted *Vasa deferentia* either are not to be found at all, or are found incapable of such an office; and having withal rejected the opinion of Women's having Seed, and affirmed, that that which makes the conception is one of those *Vesiculæ* in the *Testis*, dropping from thence and conveyed into the Womb, we must enquire by what way these can pass. For if the abovesaid Ligaments (reputed *Vasa deferentia*) have no passage whereby even the *Semen*, if there were any, might be conducted; much less could one of these *Vesiculæ* be conveyed that way. And therefore for *Vasa deferentia* we assign those Ducts that *Fallopins* in his Anatomical Observations calls *Tubæ*, and describes thus: "They are very slender and narrow Ducts, reddish and white, arising from the
" horns

“ horns (or sides) of the Womb, and at a little
“ distance from it they become larger, and twist
“ like the tendrel of a Vine, till near their end,
“ where ceasing their winding they grow very
“ large, and seem membranous, and carnous
“ from their red colour. Which end is very much
“ torn and jagged like the edge of rent Cloaths :
“ and has a large Foramen, which (says he) al-
“ ways lies closed, because those jags fall toge-
“ ther ; but yet being opened carefully, they are
“ like the utmost orifice of a Brass Trumpet.]
But *de Graef* says, though they grow very large
towards their end, yet of a sudden the very ex-
tream part is narrowed before it is divided into
the aforesaid jags, which he resembles unto leaves.
Who also appeals unto Experiment for these *Tu-
be*’s being pervious, affirming that if one put a
little Tube into the beginning of one of these
same Trumpets and blow it, the wind will pre-
sently break through it, which he saith he has
observed in all the kinds of Animals that he has
dissected.

“ These *Tube* (according to Dr. *Harvey*) are
“ the same in Women that the *Cornua* or Horns
“ of the Womb are in other Creatures. For they
“ answer to those both in situation, connexion,
“ amplitude, perforation, likeness, and also office :
“ for as other Animals always conceive in the
“ *Cornua*, so it has been sometimes observed (as
by *Riolanus* from others ; and by Dr. *Harvey*
himself) “ that a conception has in a Woman
“ been contained in one of the *Tube*.] Which
must have happened, when the *Ovum* being re-
ceived out of the *Testis* into it, has been stopt
in its passage to the Womb, either from its own
bigness, or some obstruction in the *Tuba*.

Their

Their substance.

Their *substance* is not nervous (as *Fallopian* in the above-recited description affirms) but membranous. For they consist of two *Membranes*, the *outer* and *inner*. The *inner* springs from (or at least is common with) the inmost Membrane of the Womb ; but whereas it is smooth in the Womb, it is very wrinkled in the *Tuba*. The *outer* is common with the outmost of the Womb ; and this is smooth.

width.

The *capacity* of these Ducts varies very much ; for in the beginning as it goes out of the Womb, it only admits a bristle, but in its progress where it is largest, it will receive ones little Finger. But in the outmost extremity where 'tis divided into jags, it is but about a quarter so wide.

Length.

They are very uncertain also in their *length* ; for from four or five, they sometimes encrease to eight or nine Fingers breadth long.

Use.

Their *use* is , in a fruitful copulation to grant a passage to a more subtle part of the Masculine seed (or to a seminal air) towards the *Testes* , to bedew the Eggs contained in them ; which Eggs (one or more) being by that means fecundated (or ripened as it were) and dropping off from the *Testis* (in the manner as shall be described Chap. 30.) are received by the extremity of the *Tuba*, and carried along their inner Cavity to the *Uterus*. For Dr. *Harvey* affirms, that they have a worm-like or peristaltick motion like that of the Guts, (*de Cervarum & Damarum Utero* , *Exercit.* 65.) And the same is affirmed by *Swammerdam*, *Not. in Prodr.*

Objections against their use answered.

Against this *Use* two *Objections* may be made ; First, that the end of the *Tuba* not adhering close to the *Testis*, when one of the *Vesicula*, (or *Ova* as we think they are) shall drop off from the *Testis*, it would more probably fall into the Cavity

of

of the *Abdomen*, than light juſt pat in the mouth of the *Tuba*. Secondly, that when it is received by it, its Duct is ſo narrow, that 'tis hard to conceive how it can paſs by it.

As to the *fiſt*; the ſame Objection may lie againſt the uſe of the Oviduct or *Infundibulum* in Hens, for neither in them does it joyn quite cloſe to the *Ovarium*, (as *Swammerdam*, &c. truly obſerves) and yet it is certain that the *Vitelli* or little Yelks (or rudiments of the Eggs) do all paſs by them to the *Uterus*. The ſame, *Swammerdam*, obſerves alſo in Frogs, in one of whom there are many hundreds of Eggs, which all paſs one after another from the *Ovarium* by the Oviduct or *Infundibulum*, and yet the mouth of the Oviduct is almoſt two Fingers breadth from the *Ovarium*, and beſides is immoveable, whereas the *Tubæ* in Women are at liberty (and are more than long enough) to embrace the *Ovarium* with their Oriſce: and we may reaſonably believe that they do ſo when a conception is made; for it is not improbable that when all the other parts of the Genital are turgid in the act of Copulation, theſe *Tubæ* alſo may be in ſome meaſure erected, and extend their opened mouth to the Teſticle, to impregnate the *Ova* with the Seminal air ſcam- ing through their Duct, and if any one be fecundated and ſeparate, to receive it afterwards by its oriſce.

As to the *ſecond Objection*, which urges the narrowneſs of theſe *Tubæ*, He that conſiders the ſtraitneſs of the inner oriſce of the Womb, both in Maids, and Women with Child, and yet obſerves it to dilate ſo much upon occaſion as to permit an egreſs to the Child out of the Womb, cannot wonder that to ſerve a neceſſary end of Nature the ſmall duct of the *Tubæ* ſhould be ſo far
widen'd

widen'd as to give passage to an *Ovum*, seeing its proportion to their duct is many times less than of the Child to the usual largeness of the said orifice.

C H A P. XXVII.

Of the Uterus or Womb, and its Neck.

HAVING treated of the *Vasa præparantia* (so called) that bring nourishment to the *Testes* or *Ovaria*, as also of these and their *Ova*, and lastly of the *Tubæ* through which the *Ova* pass to the *Uterus*; we now come to the *Uterus* it self which receives the *Ova*, and in which the conception is formed, and the *Fætus* nourished till it acquire its due maturity and be fit for the birth.

The Womb. The *Uterus* or Womb is usually divided into four parts, the *Fundus* or bottom, *Os internum* or *Cervix*, the *Vagina*, and the *Sinus pudoris* or outward Privy. Of each of these in order. And first of the *Fundus*.

Its name. This in a special manner is called the Womb, because all the rest seem to be made for its sake. It is also called the *Matrix*, from its being as a Mother to conserve and nourish the *Fætus*; and likewise *Utriculus* from its shape resembling a Bottle.

Situation. It is seated in the *Hypogætrium* or lowest part of the *Abdomen*, in the middle of that large hollow that is called *Pelvis*, and is formed by the *Ossa ilii*, *coxæ*, the *Ossa pubis*, and the *Os sacrum*. In this Cavity is placed between the Bladder and the freight Gut; so that Man being

ing bred betwixt Piss and Dung, if he would but consider his Origine, might hence draw an Argument of humility.

Its hindmost part is loose, that it might be extended as the *Fœtus* encreaseth. But its sides are tied fast by two pairs of *Ligaments*.

The first pair are further from the *Os internum*, and are broad, arising from the *Peritonæum*. They have a membranous, loose, and soft substance, and for their shape are resembled to bats wings. They tie the sides of the *Fundus*, the *Testes*, and a good part of the *Tube* together, and are fasten'd to the *Ossa ilii*, whereby the Womb is kept from falling down upon its Neck. But if they be either immoderately relaxed, or by any violence broken, then the Womb descends, and sometimes falls out (turning inside outwards) if the substance of the Womb happen to be relaxed also.

The second pair arise nearer to the inner orifice of the *Vagina*, about where the *Tube* do, and are called the round Ligaments, or worm-like. From their origine which is broad, they ascend on each side between the duplicature of the *Peritonæum* toward the Groins, and running out of the Cavity of the *Abdomen* become round, and then pass obliquely above the *Os pubis* towards the fat of *Mons Veneris*, in which they terminate near the *Clitoris*, being divided into many parts or jags, as may be seen in the following Figure. They consist of a double Membrane, the inner whereof has all sorts of Vessels, Nerves, Arteries, Veins, and *Vasa Lymphatica*; and are about a span long. *Veslingius*, *Diemerbroeck*, &c. say that they receive a small Seminal vessel from the *Testes* and *Tube*, which they conduct to the *Clitoris* into which they are inserted, and ought rather to be accounted *Vasa deferentia* than Ligaments.

So

So that what some Women emit from about the *Clitoris* in coition they think to be true *Semen* conducted hither by those seminal ducts. But *de Graef* denies any such ducts, and affirms that these Ligaments reach not the *Clitoris*, but are terminated in the aforesaid fat. And that humour which Women emit (sometimes) he thinks doth issue out of the *Lacunæ* in the orifices of the *Vagina* and urinary passage, or also from the *Meatus*'s in the Neck of the Womb: which humour is supplied to the former parts from the thick and membranous body that is about the urinary passage; and to the latter from the nervose-membranous substance of the neck of the Womb: but he thinks it does not partake of the nature of Seed, but serves only for the lubricating of the *Vagina* to cause the greater pleasure *in coitu*. But to this purpose more before.

Substance. Its *substance* is whitish, nervous or rather membranous; dense and compact in Virgins, but in Women with Child a little spongy and soft.

Membranes It is composed of three *Membranes*. The *outermost*, (which is common to it with all the *Viscera* in the *Abdomen*, as being derived from the *Peritonæum*) is very fibrous, compact, and tough, without any discernible Vein or Artery. The *middle* is much thicker, and endued with carnosus Fibres, and is full of Blood-vessels, very remarkable at all times, but especially in the flux of the *Menses*, or in the time of gestation. During this latter time, this Coat (with the *innermost*) imbibes so much of the nutritious humours that then flow hither, that the more the *Fætus* encreaseth, and consequently the more distended the Womb, the more fleshy and thick doth it grow. And yet (which is strange) within sixteen or twenty days

days after a Woman is brought to Bed, it becomes as thin as before, and the whole Womb contracts into so little a compass as to be held in ones hand.

The *inmost* likewise abounds with Blood-vessels propagated into it from the middle one, and is full of pores by which the blood in the menstrual flux is extravasated out of the Arteries into the Womb, and upon impregnation the *Succus nutritius* exfudes into the same, and by which also, both blood and chyle are conveyed into the *placenta uterina* after the formation thereof.

In Virgins it is about two Fingers breadth *Bigness*, broad, and three long. In those that have lain with a Man it is a little bigger, and something larger yet in those that have born Children.

In *shape* it is something like a Pear, only a *Figure*, little flattish above and below. But in Women with Child it becomes more round.

In Maids its *Cavity* is so small that it will hardly hold a large Hazel-nut. In those that have had Children it will hold a small Walnut. It is divided into no Cells as it is in most viviparous Brutes, but only into the right and left side by a Suture or line that goes lengthways, much like that on the outside of the *Scrotum* in Man. Its Cavity is not quite round, but jets out a little towards each side; which jetting some call its Horns, but improperly: for though *Galen* (and many after him) having never dissected any Woman, presuming that their Womb was like that of other viviparous Creatures, attributed *Cornua* thereto, yet in truth they have none; but the *Tubæ Fallopiæ* (as was noted before) answer
to

to them in many respects. Only in Brutes (viz. such as have *Cornua*) the conception is always formed in the *Cornua*, as being the greatest part of the *Uterus*, (which from the very orifice of its *Fundus* is presently divided into them, as when one parts the fore from the middle Finger as wide as one can) but very rarely in the *Tubæ* in Women, but most an end in the *Fundus* it self. Of which more in Chap. 30.

Arteries.

Its *Arteries* spring partly from the *Spermatick* or *Præparantes*, and partly from the *Hypogastrick*. These two *Arteries* do on each side by a notable branch inosculate one with the other. And both their branches that run on one side the Womb, do inosculate with those of their own stock on the other. Which may plainly be seen by blowing into the Trunk of either of them on which side you will, for then the branches on the other side will be puffed up, as well as those on that side you blow.

They run along the Womb not with a straight or direct course, but bending and winding, that they may be extended without danger of breaking when the Womb is enlarged to so great a bulk by the *Fætus*. By these *Arteries* it is that the *Menses* flow, in greatest quantity out of those that open into the *Uterus* it self, but in lesser out of those branches that reach and open into the *Cervix* or neck of the Womb, and in least (if at all) out of the *Vagina*.

As to the reason of the menstrual flux; 'tis not likely that the redundance of blood is the sole cause of it; for then would the term of the flux come sooner or later accordingly as the Diet should be more full, or more sparing. Whereas experience shews, that let a Woman feed never so high, and so breed never so much blood, this flux

flux comes never the sooner, (though perhaps it may be larger;) or let her use the most spare diet, and (if she be healthful) it will be never the longer a coming. Wherefore besides a sufficient stock of blood there seems requisite also a fermentation therein, to the producing this flux. Which fermentation by what it should be caused; is hard to determine. Those who grant Seed to Women, derive it thence, because as soon as Girls come to puberty, and desire and become fit for coition, the *menfes* begin to flow. But concluding, according to the Moderns, that women have no Seed, the same can be no cause hereof. Astrological reasons I account vain, seeing there are menstruous women at all seasons; and the same women have their *menfes*; in process of time, at all ages of the Moon. Other reasons may by the Curious be offered, but all those I have met with are unsatisfying. Waving them therefore, but supposing a fermentation in the blood to be the principal cause, we shall only add a word of the immediate reason or manner of the Flux: When through this fermentation the blood flows so plentifully into the Uterine Arteries, that the Veins (which are fewer than the Arteries) cannot return it all back again by the circulation; it bursts forth of the extremities of the Arteries so long, till the too great quantity of the blood be lessen'd and the fermentation ceases; which it does ordinarily after three or four days; and so the flux stops till the next period. In Women with Child they seldom flow, either because the redundant blood is then bestowed on the nourishment of the *Fœtus*; according to the old Hypothesis; or according to the new; because it is defrauded of a considerable part of the Chyle (or nutritious

O

juice)

juice) which is consumed by the *Fœtus*, whereby it becomes diminished and depauperated, which is the reason why Nurses also seldom have them.

Veins.

The *Veins* do likewise spring from the *Præparantes*, and from the Hypogastrick. There are many anastomoses of these *Veins* one with another, (as there was noted of the *Arteries*) but especially in the sides of the *Uterus*, which do more readily appear by blowing of them up, than those of the *Arteries* above spoken of. The blood brought hither by the *Arteries*, that is not spent on the ordinary nutrition of the Womb, or is not cast out when the *menfes* flow, returns by these *Veins* back to the Heart.

Nerves.

It has *Nerves* from the *Plexus mesenterii maximus* of the Intercoastal pair, and from the lowest *Plexus* of the same. As also from the *Nerves* of *Os sacrum*. And the same run also to the *Testes* or *Ovaria*. Now it is these *Plexus* of *Nerves* that are chiefly affected in the Hysterical passion, or Fits of the Mother. For these Fits are merely Convulsive, and often happen without any fault of the Womb at all. And that symptom that in such Fits is usual, namely when something like a Ball seems to rise from the bottom of the Belly and to beat strongly about the Navel (which is usually taken by women for the rising of the Womb or Mother) is nothing but the Convulsion of these *Plexus* of *Nerves*: which one will the rather believe, when he considers that some men are afflicted with the same symptom. Of which see more in Dr. *Willis* (*in Cerebr. anat. p. 201.*) who derives the pain of the Colick also from the same cause.

Lympheducts.

De Graef says, there are many *Lympheducts* that creep through the outer substance of the *Uterus*, which

which one after another meeting into one, empty themselves into the common Receptacle: And these, he says, *Bartholin* mistakes for *Venæ lactæ*.

The use of the Womb is to receive into its capacity the principles of the formation of the *Fætus*,^{Use.} to afford it nourishment, to preserve it from injuries, and at length when it is grown to maturity and requires the light and a freer air, to expel it forth.

The *Cervix* or *Os internum* of the Womb being continuous to it and coming betwixt it and the *Vagina*, we will treat of it in this Chapter. It seems to be a part of the *Fundus* or of the Womb properly so called, only it is much narrower, for its Cavity is no wider in Virgins than a small Quill, and in women with Child its inner Orifice doth either quite close its sides together, or is daub'd up with a slimy yellowish humour, so that nothing can then enter into the Womb, unless in very lustful Women it be sometimes open'd in superfoetation. It is an Inch or more in length. Its Cavity as it opens to the *Vagina* is compared to the mouth of a Tench; *Galen* likens its passage to that in the *Glands* of a Man's *Penis*; for it is not round, but long and transverse. It is wrinkled, and has many small ducts opening into it, out of which one may press a pituitous serous matter. It has the same Membranes and the same Vessels with the *Uterus* it self. *De Graef* says that amongst its wrinkles he has often observed *Hydatides* or little watry Bladders; and thinks, that the abovesaid serous matter serves only to moisten the *Vagina*, &c. and to excite to Veneriy.

CHAP. XXVIII.

*Of the Vagina, and its Contents, viz. the Hy-
men and Carunculæ myrtiformes.*

Vagina.
Its name.

Continuous unto the *Cervix* is the *Vagina*, so called, because it receives the *Penis* like a *Sheath*. It is called also the *door of the Womb*, and its *greater Neck*, to distinguish it from the lesser just now described in the foregoing Chapter.

Descrip-
tion.

It is a soft and loose Pipe, uneven on its inside with orbicular wrinkles, of a nervous but somewhat spongy substance (which lust causeth to puff up a little, that it may embrace the Yard more closely) about seven Fingers breadth long, and as wide as the streight Gut: all which yet, both length, width, and looseness differ in respect of age, &c. and as a woman is inflam'd more or less with lust. So also the aforesaid wrinkles are much more numerous and close set in Virgins, and in women that seldom accompany with a man, and that have never born Children, than in those that have born many Children, and in Whores that use frequent copulation, or those that have long laboured under the *fluor albus*, for in all these three sorts they are almost obliterated. Its thickness on the upper side, (according to *de Graef*) is about a straws breadth; but on its lower it is twice as thick. *Stockhamer* says, it consists of a spongy and glandulous substance, through which not only plentiful branches of Veins and Arteries, (*viz.* from the hypogastrick and hemorrhoidal) are dispersed, as also Nerves from the *Os sacrum*; but it has also proper excretory Ducts, which gape like pores into

into its inner cavity, and are most numerous near the urinary passage. And this substance, he says, is contained between two Membranes, of which the inner is nervous and wrinkled; the outer, carnosus.

It has very many *Arteries* and *Veins*, some of *Vessels*. which inosculate one with another, and others not: By the *Arteries* that open into it do the *Menses* sometimes flow in Women with Child that are plethorick: for they cannot come from the Womb it self, unless abortion follow, as sometimes it does. These *Vessels* bring plenty of blood hither in the venereal congress, which heating and puffing up the *Vagina* encreaseth the pleasure, and hinders the Man's Seed from cooling before it reach the *Uterus*. They spring not only from the Hypogastrick, but also from the Hemorrhoidal, but these latter run only through the lower part of the *Vagina*. Its *Nerves* Dr. *Willis* thus describes: From the lowest *plexus* of the *Abdomen* two *Nerves* are sent into the *Pelvis*, where each receives a notable vertebral Nerve; and so they make two *plexus*, one on each side, from which there arise two ascending *Nerves* that run to the *Intestinum rectum*, and two descending that are carried to this part we are speaking of.

Casp. Bartholin relates that in a Cows *vulva* he *Glands*. was shewn by *Jos. du Verney*, a *Gland* on each side of it, somewhat on the hinder part, each of which has a duct running from it opening into the *vulva*, but at its orifice has a notable *papilla* placed which closes it, so that no liquor can pass out but by the protuberating and unclosing of the *papilla* in coitu. He says, he has not yet observed them in Women, but inclines to believe they are not wanting in them; and thinks that that li-

quor which is sometimes emitted by them with pleasure, issues a great part of it from hence. The Glands, he says, are of the conglomerate kind, and are invested round with peculiar and proper carnous Fibres, which seem to arise from the Sphincter of the Bladder, as those which encompass the *Prostata* in Men do according to the observation of *de Graef*: and therefore he thinks these Glands in Females are in lieu of the *Prostata* in Men.

The insertion of the Neck of the Bladder.

Near its outer end, between the *Nymphæ* (of which in the next Chapter) in its fore and upper part it receives the neck of the urinary Bladder encompassed with its Sphincter: opposite whereto in its hinder or lower part it is strongly knit to the Sphincter of the streight Gut. The urinary passage, or *Urethra*, is not above two Fingers breadth long from the neck of the Bladder to its end, and about as thick as a Goose-quill.

Hymen.

The *Hymen* is a thin nervous Membrane interwoven with carnous Fibres, and endowed with many little Arteries and Veins, spread across the duct of the *Vagina*, behind the insertion of the neck of the Bladder, with a hole in the midst that will admit the top of ones little Finger, by which the *Menses* flow. It is otherwise called the Zone or Girdle of Chastity. Where it is found in this form described, it is a certain note of Virginity; but upon the first congress with a Man it is necessarily violated, which is usually accompanied with an effusion of Blood; which blood is called the *Flower of Virginity*; and of this the holy Text makes mention in *Deut.* 22. verses 13.—21. And when once it is broke, it never closes again.

But

But though this effusion of blood upon coition from the rupture of this Membrane, (or perhaps of Capillary vessels in the *Vagina*) be a certain token of Virginitiy; yet it will not follow on the contrary, that where it is wanting, Virginitiy is also wanting. For the *Hymen* may be corroded by acrimonious fretting humours flowing through it with the *Menses*; or may be violated by the falling out or inversion of the *Uterus* or the *Vagina* at least, which sometimes happens even to Maids; or lastly, perhaps the indiscreet and unwary Bride has had her *Menses* a day or two before, in which case both the *Hymen* and the inner wrinkled Membrane of the *Vagina* are so flabby and relaxed, that no such rupture, and by consequence no such effusion may happen.

In some there naturally wants a *foramen* in the *Hymen*, by which means there being no exit for the *Menses*, such are in great peril of their life, if they be not relieved by Surgery, viz. by opening it with some sharp Instrument.

Close to the *Hymen* lie the four *Caruncula myrtiformes*, so called from their resembling Myrtle-berries. The largest of them is uppermost, standing just behind the mouth of the Urinary passage which it helps to shut. Opposite to this in the bottom of the *Vagina*, there is another, and on each side one, so that they stand in a square. But of these there is only the first in Maids, the other three are not indeed Caruncles, but little knobs made of the angular parts of the broken *Hymen* roll'd into a heap by the wrinkling of the *Vagina*, according to *Riolanus* and *Diemerbroeck*. These three when the *Vagina* is extended in a Woman's labour, lose their asperity and become smooth, so

that they disappear, until it be again contracted to its natural straitness.

The Sphincter Muscle. De Graef affirms, "that the *Vagina* near its outer orifice has a Sphincter muscle almost three Fingers broad, that upon occasion constringes or contracts it. Which constriction is more particularly described by *Stockhamer*, who says, "it is performed partly by means of the Fibres that run through the outer carnosus coat of the *Vagina*; and partly by this Sphincter Muscle, and two Net-like *plexus* which in their composition are like the nervous bodies of the *Penis*, or of the *Clitoris*; for they consist of vessels and fibres water'd with black blood, and clad with a thin Membrane; they climb on either side of the *Vagina* near its outer orifice, and notably help to constringe it when they are puffed up with spirituous blood in coition; for by their swelling they drive the sides of the *vagina* inwards; which that they may the better do, the Sphincter muscle (ascending from the Sphincter of the *Anus*) doth outwardly cover these *plexus*, that by its constriction it may hinder them to swell outwardly.

The use of the Vagina. Having thus described the parts of the *Vagina*, its use is easily declared to be, to receive the Man's Yard, being erect, to direct and convey the Seed into the Womb, to serve for a Conduit by which the *Menses* may flow out, and to afford a passage to the *Fetus* in its birth, and to the After-birth.

C H A P. XXIX.

*Of the Pudendum muliebre , or Woman's
Privity.*

THE parts that offer themselves to view without any diduction, are the *Fissura magna* or great Chink, with its *Labia* or Lips, the *Mons Veneris* and the Hairs. These parts are called by the general name of *Pudenda*, because when they are bared, they bring *pudor* or shame upon a Woman.

The great *Chink* is called *Cunus* by *Galen* à *Fissura*, *uter*, to conceive; by *Hippocrates*, *Natura*. It is also called *Vulva*, *Porcus*, *Concha*, and by many other Names that Fancy has imposed upon it.

It reaches from the lower side of the *Os pubis* to within an Inch of the *Anus*; being by Nature made so large, because the outer Skin is not so apt to be extended in travail as the membranous *Vagina* and *Collum minus* are. It is less and closer in Maids than in those that have born Children. Its length makes the *Perinaeum* not to be above an Inch long. It has two Lips, which towards the *Pubes* grow thicker and more full or protuberant, and meeting upon the middle of the *Os pubis* make that rising that is called *Mons Veneris*, or the Hill of *Venus*.

The inner substance of this Hill, which makes *Mons Veneris* bunch so up, is most of it fat; and under the neris-fat lies that *Sphincter* muscle that we spoke of in the last Chapter, that constricts the orifice of the *Vagina*, and springs from the *Sphincter ani*.

By a little drawing aside the *Labia*, there then appear the *Nympha* and the *Clitoris*.

The

Nymphæ.

The *Nymphæ* are so called because they stand next to the Urine as it spouts out from the Bladder, and keep it from wetting the *Labia*. They are called also *πτερυγία*, or Wings. They are placed on each side next within the *Labia*, and are two carnosus and soft productions, beginning at the joyning of the *Ossa pubis* or upper part of the Privity, (where they are joyned in an acute angle, and make that wrinkled membranous production that clothes the *Clitoris* like a *Præputium* or Fore-skin) and descending close all the way to each other, when the *Pudendum* is shut, reaching but about half the breadth of the orifice of the *Vagina*, and ending each in an obtuse angle. They are almost triangular, and therefore, as also for their colour, are compared to the thrills that hang under a Cock's throat.

Their substance.

They have a red *substance*, partly fleshy, partly membranous; within soft and spongy, loosely composed of thin Membranes and Vessels, so that they are very apt to be distended by the influx of the Animal spirits and arterial blood. Spirits they have from the same Nerves that run through the *Vagina*, and blood from that branch of the inner Iliacal Artery that is called *Pudenda*: Veins they have also from the *Vena pudenda*, which carry away the Arterial blood from them when they become flaccid. They are larger in grown Maids than in younger, and larger yet in those that have used Venery or born Children.

Use.

Their *use* is to defend the inner parts, to cover the Urinary passage, and a good part of the orifice of the *Vagina*. And to the same purposes serve the *Labia* above described.

Above

Above betwixt the *Nymphæ* in the upper part of the *Pudendum* does a part jet out a little that is called *Clitoris*, from κλητρίς, that signifies lasciviously to grope the *Pudendum*. It is otherwise called *Virga*, for it answers to a Man's Yard in shape, situation, substance, repletion with spirits and erection; it has nervous bodies, a *septum*, a *glans*, muscles and the like Vessels with the *Penis*. But it differs therefrom, first in magnitude; for this is very small in respect to that, as being not to be blown up to the thickness of ones little Finger. Secondly, the forked roots of the nervous bodies that lye hid within the fat of the *Pubes*, are twice as long as that part of it which is united into one body with the *septum* between; whereas on the contrary in the *Penis* the united part is four times as long as the forked. Thirdly, the *Clitoris* wants an *Urethra*, and its prominent *glans* wants a *foramen*. Fourthly, it has only one pair of Muscles. In some its united part grows to that length, as to hang out from betwixt the Lips of the *Pudendum*: yea there are many stories of such as have had it so long and big as to be able to accompany with other Women like unto Men, and such are called *Fricatrices*, or otherwise Hermaphrodites; who it's not probable are truly of both Sexes, but only the *Testes* fall down into the *Labia*, and this *Clitoris* is preternaturally extended. But in most it jets out so little as that it does not appear but by drawing aside the *Labia*.

It is a little, long and round body, consisting (like a Man's *Penis*) of two nervous, and inwardly black and spongy parts, that arise on each side from the bunching of the *Os Ischium*, and meet together at the joynting or conjunction of
its substance.

of the *Ossa pubis*. It lies under the fat of *Mons Veneris*, in the top of the great fissure. In Venerary by means of the two nervous bodies it puffs up, and straitening the orifice of the *Vagina* contributes to the embracing of the *Penis* the more closely.

Glans.

Its outer end is like to the *Glans* of a Man's Yard, and has the same name, (as also *Tentigo*.) And as the *Glans* in Men is the seat of the greatest pleasure in copulation, so is this in Women; whence it is called *Amoris dulcedo* and *Ostrum Veneris*. It has some resemblance of a *Foramen*, but it is not pervious. It is most of it covered with a thin Membrane from the conjunction of the *Nymphae*, which for its likeness to the *Preputium* in Men, is also called so.

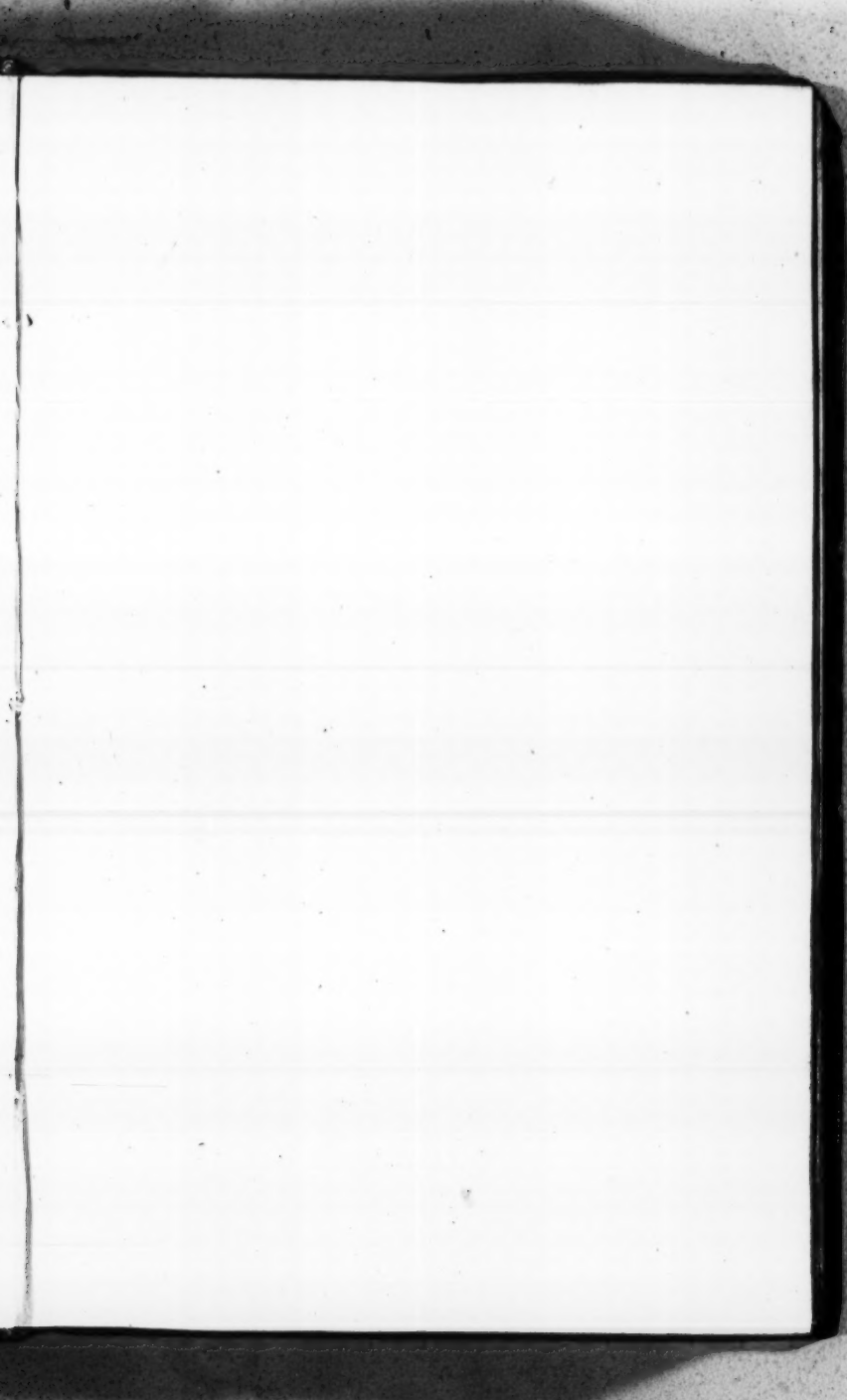
Muscles.

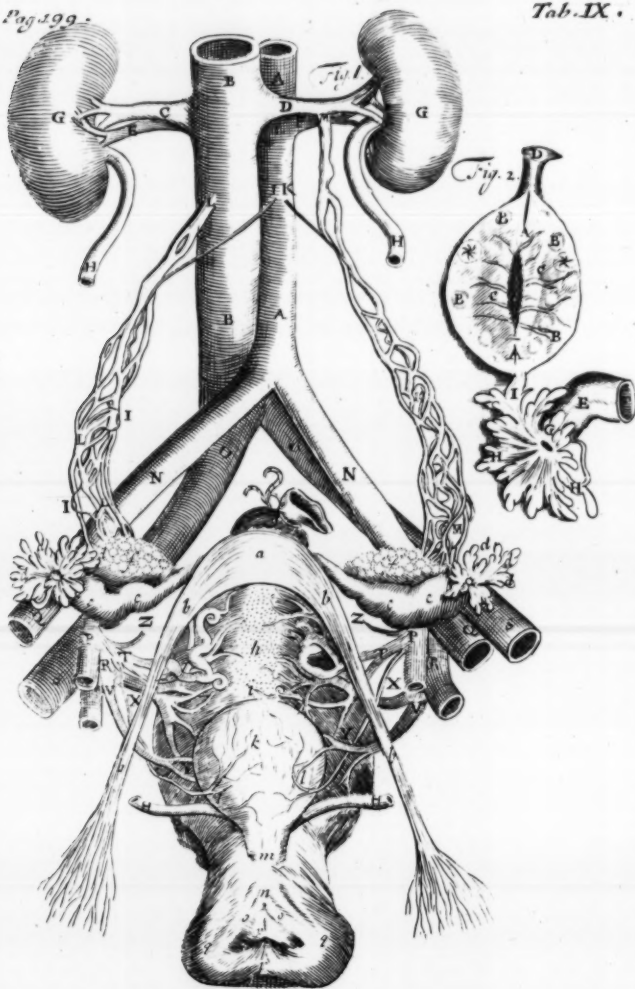
The *Clitoris* has formerly been affirmed to have two pair of *Muscles* belonging to it. The upper are round, and spring from the Bones of the *Coxendix*, and passing a little way along the two nervous bodies above-described are inserted into them. These by straitning the roots of the said bodies do detain the Blood and Spirits in them, and so erect the *Clitoris*, even as those in Men do the *Penis*. And this is the only pair which we suppose belong to the *Clitoris*. As for the other which arise from the *Sphincter ani*, they are those we mention'd above in the end of the foregoing Chapter: for though they have been thought to serve for the erection of the *Clitoris*, yet we think with *de Graef*, that they are rather of the nature of a *Sphincter*, and contribute to the purging up or constringing the outer orifice of the *Vagina*.

Vessels.

It has *Veins* and *Arteries* from the *Pudenda*, and *Nerves* from the same origine with the *Vagina*, which are pretty large.

Its





Its *use* may be known from what has already been discoursed. And we will only note further, that in some Eastern Countries it *uses* to be so large, that for its deformity and the hinderance it gives to copulation, they *use* to cut it quite out, or hinder its growth by searing it, which they improperly call Circumcision.

Tab. IX.

Fig. I. Representeth the Genital parts of a Woman taken out of the Body, and placed in their natural situation.

AA The trunk of the great Artery.

BB The trunk of the Vena cava.

C The right Emulgent vein.

D The left Emulgent vein.

E The right Emulgent artery.

F The left Emulgent artery.

GG The Kidneys.

HHHH The Ureters as they rise from the Kidneys and are inserted into the Bladder, but their middle part cut off.

III The right Spermatick artery.

KK The left Spermatick artery.

LL The right Spermatick vein.

MM The left Spermatick vein.

NN The Iliack arteries.

OO The Iliack veins.

PP The inner branches of the Iliack artery.

QQ The outer branches of the Iliack artery.

RR The inner branches of the Iliack vein.

SS The outer branches of the Iliack vein.

TT The Hypogastrick arteries carried to the Womb and Vagina.

UU The Hypogastrick veins accompanying the said arteries.

XX The

- XX The branches of the Hypogastrick artery tending to the urinary Bladder.
- YY The branches of the Hypogastrick vein carried to the Bladder.
- ZZ Portions of the Umbilical arteries.
- a The Fundus uteri clothed with its common Coat.
- bb The round Ligaments of the Womb as they are joyned to its Fundus.
- cc The Tubæ Fallopianæ in their natural situation.
- ddd The Fimbriæ or jags of the Tubæ.
- ee The Foramina of the Tubæ.
- ff The Testicles in their natural situation.
- g A portion of the streight Gut.
- h The neck of the Womb, divested of its outer Coat, that the Vessels may be better seen.
- i The fore-part of the Vagina of the Womb, freed from the urinary Bladder.
- k The urinary Bladder contracted.
- ll The Blood-vessels running through the Bladder.
- m The Sphincter muscle constringing the neck of the Bladder.
- n The Clitoris.
- oo The Nymphæ.
- p The Urinary passage.
- qq The Lips of the Pudendum.
- r The orifice of the Vagina.

Fig. II. Exhibiteth a Woman's Testicle or Ovarium with the end of the Tuba annexed to it.

- A The Testicle opened lengthways in its lower part.
- BB Eggs of divers bigness contained in the membranous substance of the Testes.
- CC The Blood-vessels in the middle of the Testes, proceeding plentifully from its upper part, as they run to the Eggs.

DD The

- DD *The Ligament of the Testicles, whereby they are knit to the Womb, cut off.*
EE *A part of the Tuba Fallopiana cut off.*
F *The Cavity of the Tuba cut off.*
GG *The hole that is in the end of the Tubæ.*
H *The leavy ornament of the Tubæ.*
I *The leavy ornament of the Tubæ knit to the Testes.*

C H A P. XXX.

Of a Conception.

HAVING described all the parts that serve for *Generation* both in Man and Woman, Order would that we should speak of the *efficient causes, matter or principles*, from whence that which is generated by and in them, doth proceed. And in the first place there occurs the Man's Seed, which is the *active principle*, or *efficient cause* of the *Fætus*; but when we discoursed of the *Testes*, we shewed what the *matter* of it was, *viz.* Arterial blood and Animal spirits; and as to the manner of its fecundating the *Ovum*, we omit that, as being too Philosophical for this place. In the next place therefore we must come to the *matter or passive principle* of the *Fætus*, and this is an *Ovum* impregnated by the Man's Seed. And here because in Women it cannot be observed by what degrees and in what time an *Ovum* in the *Ovarium* or *Testis* becomes a Conception in the *Uterus*, we must be forced to guess at that by the analogy in other Creatures. To this purpose Dr. *Harvey de generatione Animalium*, is worthy to be read of the Curious; especially concerning the

the manner and order of the generation of the parts of a Chicken in an Hen's Egg, in his *Exercit.* 56. But when he comes to apply this to the Conceptions of viviparous Animals, being ignorant that there was any formal *Ovum* pre-existing in them, and only then fecundated, he runs into great Errors and odd Notions about Conception; Imagining an analogy betwixt the Brain's forming its Phantasms or Conceptions, (which he calls *Animal*) and the Wombs forming hers, which he calls *Natural*. He rightly indeed rejects the Hypothesis of the Woman's having true Seed, as also the Notion that the Man's Seed is any part of the Conception; but then he gives an unsatisfactory account of it, when he says, it is formed of the primeval albugineous humours that transude into the *Cornua* in Brutes, or *Uterus* in Women, after they are impregnated or matur'd, as he speaks. For those albugineous humours (as shall be shewn more fully afterwards) are not the first principle from which the *Fœtus* is formed, but the matter whereby its Lineaments first drawn within the *Ovum*, receive their encrease and perfection. I shall not therefore rehearse the History of generation in Harts that he has given us, for an analogical explication of that in Women; but shall transcribe the observations of the Curious *de Graef* concerning the generation of Rabbits, as being more adapted to our purpose, and more consonant to truth.

"We made the first Tryal (*says he*) on a female Rabbet that had not yet accompanied with the male. Dissecting which we observed a very wide *Vagina*, and about eight Fingers breadth long; which being opened lengthways, there stood out two narrow mouths in its upper part divided with a semilunar partition;

“tition, namely the beginning of each *Cornu* :
“for the Womb in Conies is presently from the
“very *Vagina* divided into two parts, one of
“which bends towards the right hand, the other
“towards the left, about three Fingers breadth
“asunder, where they are presently contracted
“and continued with the Oviducts, which in
“these Animals have a peculiar situation (or
“make :) because if you lightly blow up the *Cornu*
“*nua*, these will not swell, nor the wind penetrate them because of some loose *Fimbriae* or
“jags closing like the Valve of the Gut *Colon*.
“These Oviducts being small at their rising from
“the *Cornua*, for five Fingers breadth run with
“a winding Duct beyond the Testicles, widening
“more and more by degrees, and then they
“turn back towards them, and end in the form
“of a Tunnel. The Testicles are small, but
“contain very many limpid Eggs, which being
“cut open, there issued out a clammy liquor like
“the White of an Egg. This being premised,

“We opened another half an hour after the
“*Coitus*, the *Cornua* of whose *Uterus* look'd a little
“redder, but the *Ova* in the Testicles were
“not yet chang'd, unless they had remitted a
“little of their clearness : but neither in the *Vagina*
“nor in the *Cornua* could we perceive any
“Seed, or any thing like it.

“About six hours after the coupling we dissected another, in whose Testicles the *Folliculi*
“ (or Cases) of the *Ova* inclined to redness,
“out of which being pricked with a Needle; a
“clammy and clear liquor issued first, but blood
“followed, flowing out of the Sanguinary vessels
“dispersed through the *Folliculi* : We could find
“no Seed neither in this Coney.

“ Four and twenty hours after the *Coitus*, we
“ opened another, in one of whose Testicles we
“ found three, and in the other five *Folliculi* of
“ the *Ova* very much changed; for being before
“ limpid and colourless, they were now turn’d
“ duskyish and of a faint red, in the middle of
“ whose Superficies a little *Papilla* (or Teat) as
“ it were discover’d it self: when the *Folliculi*
“ were cut open, there appear’d a little limpid
“ liquor in their middle, and in their circumfe-
“ rence a certain thicker and reddish matter.

“ Twenty seven hours after the *Coitus* we in-
“ spected another, the *Cornua* of whose *Uterus*
“ with the Oviducts looked more bloody, also
“ the extremity of the Oviducts did on every side
“ embrace the *Testes* like a Tunnel; in the mid-
“ dle superficies of the *Folliculi*, as in those be-
“ fore, there stood out little *Papilla*, through
“ which by pressing the substance of the Testi-
“ cles there issued a limpid liquor, which was
“ followed by another redder and thicker. Open-
“ ing the *Cornua* of the Womb we found no Eggs,
“ but the inner wrinkled Tunicle of the *Cornua*
“ was a little more tumid.

“ Eight and forty hours after the *Coitus* we
“ examin’d another, in one of whose Testicles
“ we found seven, in the other three *Folliculi*
“ changed, in whose middle the *Papilla* were
“ something more eminent, through which, by
“ pressing the substance of the Testicles, there is-
“ sued a little liquor like the White of an Egg,
“ but the remaining reddish substance of the
“ *Ova*, being now become something thicker,
“ was not so easily pressed forth as in those
“ before.

“ Two

“Two and fifty hours after the *Coitus* we viewed another, in one of whose Testicles we found one, in the other four *Folliculi* altered; cutting open which we found a glandulous-like matter, in the middle of which there was a little Cavity, wherein finding no notable liquor, we begun to suspect whether or no their limpid substance, which is contained in proper Membranes, were burst forth or expelled: wherefore we searched carefully both the Oviducts and the *Cornua*, but we could find nothing; only the inner Tunicle of the *Cornua* being much puffed up, shined.

“Seventy two Hours, (or three Days and Nights) after the *Coitus* we inspected another, which exhibited a far other and most wonderful change; for the *Infundibulum* did embrace the Testicles on every side most closely, which being pull’d off we found in the Testicle of the right side three *Folliculi* a little greater and harder, in the middle of whose superficies we saw a Tubercle with a little hole in it like a *Papilla*; but dissecting the said Cases through the middle, their Cavity was quite empty: wherefore we searched the ways through which the *Ova* must pass, again and again, and found in the middle of the right Oviduct one, and in the outer end of the *Cornu* of the same side two very small Eggs, little bigger than small Pins-heads, which notwithstanding their smallness are cloathed with a double Coat; out of these Eggs being pricked, there issued a most limpid liquor. In the very beginning of the *Cornu* of the left side we found only one Egg, just like those small ones of the other side, whence it is clear that the *Ova* excluded out of the *Testes*

“ are ten times less than those that yet stick in
“ the *Testes* ; which seems to us to come to pass,
“ inasmuch as those that are still in the *Testes* con-
“ tain as yet another matter, namely that of
“ which the glandulous substance of the *Cases*
“ is made.

“ The fourth Day from the *Coitus* we opened
“ another, in one of whose *Testicles* we found
“ four, in the other three *Globules* or *Cases* em-
“ ptied ; and in the *Cornua* of the respective sides
“ we found as many Eggs, greater than the for-
“ mer, which did not stick in the *Oviducts* or
“ beginnings of the *Cornua*, but were now rolled
“ on towards their middle : in their Cavity we
“ beheld as it were another Egg swimming, far
“ clearer than in the other before.

“ The fifth day from the *Coitus*, we dissected
“ another, in whose *Ovaria* or *Testicles* we told
“ six emptied *Folliculi*, that had each a notable
“ *Papilla*, through whose *Foramen* we easily put
“ an ordinary bristle into their Cavity : we found
“ also the same number of Eggs (bigger than
“ those the day before) in divers parts of the
“ *Cornua*, in which they lay so loosely, that by
“ blowing only, one might drive them this way
“ or that way. The inner *Tunicle* of these (or
“ the Egg within an Egg as it were) was become
“ yet more conspicuous.

“ The sixth day after the *Coitus* we examin’d
“ another, in one of whose *Testicles* we observ’d
“ six *Cases* emptied, and in the *Cornu* of the same
“ side we could light of but only five Eggs
“ near the *Vagina*, brought as it were upon a
“ heap : and in the *Testicle* of the other side we
“ found four *Folliculi* emptied, and in the *Cornu*
“ of that side only one Egg : The cause of which
“ difference

“ difference we suppose to be, either because some
“ Eggs by the wave-like motion of the *Cornua*
“ (not unlike the peristaltick motion of the
“ Guts) being carried downwards towards the
“ *Vagina* were driven forth; or because being
“ consumed in the *Folliculi* they came not to the
“ *Uterus*; or light on some other mischance,
“ These Eggs were as big as small pease.

“ The seventh day from the *Coitus* we examin’d
“ another, in whose *Ovaria* we found some *Folli-*
“ *culi* emptied, that were greater, redder, and
“ harder than the foregoing, and saw as many
“ transparent Tumors or Cells in divers parts of
“ the *Uterus*; out of which being opened we tur-
“ ned *Ova* as big as Pocket-Pistol Bullets, in
“ which we beheld nothing but the inner Tunicle
“ very conspicuous and a most limpid humour.
“ It is to be wondred at, that in so short a space
“ of time the Eggs should imbibe so great plenty
“ of liquor, that whereas before they might easi-
“ ly be taken out of the Womb, now they could
“ very difficultly.

“ The eighth day from the *Coitus* we opened
“ another, in the right *Cornu* of whose *Uterus*
“ we saw one, in the left two Cells; one of these
“ was almost twice as big as the other: for Na-
“ ture doth sometimes so vary, that there are
“ Eggs of divers bigness found not only in divers
“ Animals of the same species dissected at the
“ same distance from the *Coitus*; but also in one
“ and the same Individual. In the horns of the
“ Womb being opened we saw the Eggs a little
“ bigger than the day before, but all of them,
“ their Tunicles breaking, poured out their clear
“ liquor before we could take them quite out:
“ for which reason we tried another dissected

“ likewise the eighth day after the *Coitus* ; the
“ right *Cornu* of whose *Uterus* we saw swelled up
“ into two, and the left into four transparent
“ Tumours or Cells, out of which that we might
“ take the *Ova* we used the greatest diligence
“ and attention ; but as soon as we came to them,
“ their Tunicles were so very tender that they
“ burst as the former : which when we saw, the
“ Eggs that remained we boiled with the *Uterus*,
“ whereby their Contents harden’d like the
“ Whites of Hen’s Eggs. The inner substance
“ of the Cells on that side whereon it receives
“ the Hypogastrick vessels, was become more
“ tumid and red.

“ The ninth day after the *Coitus* we dissected
“ another that was old ; the Testicles of this
“ were almost as big again as those of younger :
“ in the right we saw two, in the left five *Folli-*
“ *culi* lately emptied, and besides these, others
“ that look’d very pale, which we judged to be
“ those that had been emptied the *Coitus* before
“ this, although for the most part they leave
“ only some palish points or specks, to which the
“ encrease of the Testicles is owing. The *Folli-*
“ *culi* of the last *Coitus* were each beset with a
“ *Papilla*, but the others were smooth. In the
“ right *Cornu* there were two, and in the left
“ five Cells, whose substance being more rare and
“ pellucid than the other parts of the *Uterus*, was
“ interwoven with many twigs of Veins and Ar-
“ teries. Opening some of these Cells, we could
“ see the *Ova* ; but could not take them out
“ whole ; wherefore being compelled to examine
“ the Contents of the Eggs in the very hollow of
“ the Cells, we found it clear like Crystal ; in
“ the middle whereof a certain rare and thin
“ cloud

“ cloud was seen to swim, which in other Conies
“ dissected likewise on the ninth day after the
“ *Coitus*, for its exceeding fineness escaped our
“ sight. The inner substance of the Cells, namely
“ that which receives the Hypogastrick vessels,
“ being more tumid than the rest, exhibited the
“ rudiments of the *Placenta*.

“ The tenth day after the *Coitus* we inspected
“ another, in whose right Testicle we found one
“ onely *Folliculus* emptied, which by reason of
“ the Sanguineous vessels dispersed plentifully
“ through it, was redder and had a less *Papilla* ;
“ in the middle of this pale substance there ap-
“ pear'd as yet a very small Cavity : but in the
“ left Testicle we found six such *Folliculi*. In the
“ *Cornua* of the *Uterus* we found also so many
“ Cells, namely one in the right and six in the
“ left, distant a Fingers breadth one from ano-
“ ther, in the middle of which Cells lay a rude
“ mucilaginous draught of the *Embryo* like a little
“ Worm. One might also plainly discern the
“ *Placenta*, to which the Egg by means of its *Cho-*
“ *ri*on was annexed. The matter of the Eggs
“ boil'd with the Womb hardned like the White
“ of an Egg, and tasted like the boiled congealed
“ substance of the Eggs in the Testicles.

“ The twelfth day after the *Coitus* we opened
“ another, in one of whose Testicles we found
“ seven, in the other five *Folliculi* emptied, and
“ as many Cells in the *Cornua* much bigger and
“ rounder than the foregoing, in the middle of
“ which the *Embryo* was so conspicuous, that one
“ might in a sort discern its Limbs. In the regi-
“ on of its breast two sanguineous specks, and as
“ many white ones did offer themselves to view :
“ in the *Abdomen* there grew a certain mucilagi-

“ nous substance inclining here and there to red.
“ We could not discern more in this shapeless
“ little Animal because of its tenderness.

“ The fourteenth day after the *Coitus* we dissected another, the Cells of whose *Uterus* we beheld to be yet greater, and their sanguineous vessels more, and more turgid: we also noted that the Cells the larger they grew, came also nearer to one another, and their Interstices were lessened. The Membranes *Amnios* and *Chorion* were knit together, which though they appear thicker and stronger, are yet more hard to be separated from one another than in the *Ova* taken intirely out of the Womb; tearing these we saw an *Embryo* with a great and pellucid Head, with the *Cerebellum* copped; its goggle Eyes, gaping Mouth, and in some sort its little Ears might be discovered also. Its Back-bone was drawn out, of a white colour, which bending in about the *Sternum* resembled a Ship; by whose sides most slender Vessels run, whose ramifications were extended to the Back and Feet. In the region of the Breast two sanguineous specks greater than the foregoing exhibited the Rudiments of the Ventricles of the Heart; at the sides whereof were seen two whitish specks for Lungs. In the *Abdomen* being opened, there first shew'd it self a reddish Liver; then a white Body, to which was knit a mucilaginous matter like a writhed thread, being the rudiments of the Stomach and Guts. All which in those that we dissected afterward had acquired only a greater bulk and perfection. And therefore to prevent tediousness by repeating the same things, we will on purpose pass by all the other dissections we made “ in

“ in this kind of Creature , excepting only one
“ which we made the day before the kindling ;
“ that those things that in the former were only
“ confusedly discerned , may appear plain in
“ this.

“ At length on the twenty ninth day after the
“ *Coitus* we inspected another , that had kindled
“ six weeks before, and in the *Coitus* by which
“ she was impregnated had voided all the thicker
“ part of the Seed of the Male , which in some
“ measure did resemble the consistence of a most
“ limpid jelly. In her *Ovaria* we found eleven
“ little whitish *Folliculi*; and besides these, others
“ far less, little or nothing differing from the
“ substance of the *Testes*. The *Folliculi* of the
“ *Ova* in the *Testes* seem not to vanish wholly,
“ but to leave a certain speck in them ; whence
“ it certainly comes to pass, that Conies, the oft-
“ ner or the more young ones they bring forth,
“ have the greater and whiter Testicles ; so that
“ one may guess by only viewing the *Testes*, whe-
“ ther they have had many young ones or often.
“ Having view'd the *Ovarium* we past to the *Ute-*
“ *rus*, which we found no longer distinguish'd in-
“ to Cells, but all along distended like a Pud-
“ dling ; which was so agitated with a wave-like
“ motion , like the peristaltick of the Guts, that
“ the young ones nearest the *Vagina* as yet in-
“ cluded in their Membranes were excluded, and
“ that so hastily , that if we had not cut out the
“ whole *Uterus*, they had all certainly gone the
“ same way. The Womb was no thicker than when
“ they are not with young, otherwise than we have
“ said it to be in Women. In its Cavity we
“ saw eleven *Fœtus* sprawling , which were all
“ so closely coupl'd together by the Membrane
“ *Chorion* (wherein all are severally involved)
“ as

“as if they had all been included in one and the
“same *Chorion*——

Thus much I thought fit to translate of that accurate Anatomist's Observations concerning the generation of this sort of Animal, because it gives so very great light into the manner of the generation of an humane *Fœtus*. For there is an exact analogy betwixt them, abating some circumstances; as *First*, that in Women the Conception is not formed in the *Cornua*, seeing her Womb has none, nor in the *Tubæ* very seldom and according to nature, for they are only the *Infundibula* or *Oviducts* to convey the *Ova* from the *Testes* to the *Fundus uteri*, though they bear some resemblance to the *Cornua* in Brutes; I say the conception is not formed in these, but in the *Fundus uteri* or Womb properly so called, whereinto the *Ovum* being received, presently begins to swell and grow bigger, and there appears as it were an Egg within an Egg, by means of the two Membranes with which it is cloathed; which Membranes are originally in the *Ovum* while it is in the Testicle, and imbibe the moisture that is sent now plentifully into the Womb, even as the little Yelks in Hens, &c. gather the White about them in the *Oviduct* and *Uterus*, which they have none of in the *Ovarium*; or as Seeds in the Ground do imbibe the fertile moisture thereof to enable them to sprout. Another considerable circumstance wherein they differ, is the slow procedure of the formation of the *Fœtus* in Women in comparison of that in Conies now described. For seeing these go with young but 29 or 30 Days, and Women 9 Months, we must imagine that the *Embryo* is as perfectly formed in the former on the tenth Day as in the latter in
the

the tenth Week, or longer. But I say, abating these, or if there be any other such like circumstances, there is so great a likeness betwixt the one and the other, that without insisting more on the matter or manner of the Conception, we shall pass on to the description of the parts that encompass the *Fœtus*, then shew how it is nourished, and lastly what parts there are in a *Fœtus* that differ from those in a Child born.

C H A P. XXXI.

Of the Placenta Uterina or Womb-liver, and Acetabula.

UPon the cutting open the Womb of a Woman with Child, the first thing that offers it self is the *Placenta uterina*, or Womb-cake, otherwise called *Hepar uterinum*, or Womb-liver, from the likeness of substance, and also use, according to those that imposed the name.

Its *substance* is very like that of the Spleen, only that is more brittle, and this more tough and tenacious, so that it cannot so easily be separated from the Vessels. It is soft, and has innumerable Fibres and small vessels. Its *Parenchyma* is partly, if not altogether, glandulous.

Dr. *Fred. Ruysch* affirms (as he does of the Spleen) that it has no fibres, no peculiar glands, nor cells, with bloud-vessels placed between; but that its whole fabrick is only an aggeries of Arteries and Veins. Of which opinion you may see more before in chap. 16. of the Spleen.

It is of very different shapes in several Creatures, but in Women it is circular, yet with some

some inequalities in its circumference. It is two Fingers breadth thick in its middle, (but thinner near the edges) and a span or a quarter of a yard over from one side to the other when the *Fætus* is come to maturity ready for the birth. On that side next the *Fætus* it is smooth and something hollowish like Navel-wort, and grows every where firmly to the *Chorion*; but on that next the Womb it is very unequal, having a great many tubercles or bunchings, whereby it adheres fast and immediately to the Womb. But to what part of it, is not agreed among Anatomists, some affirming it to grow to the fore-part, some to the hinder-part; some to the left side, others to the right. Dr. *Wharton* (assenting to *Fallopious*) says, it always adheres to one of the two corners of the Womb (that answer in some manner to the *Cornua* in Brutes) whereinto the *Foramen* of the *Tuba* opens; so that he says, the said *Foramen* is as it were the centre to the *Placenta*. *De Graef* thinks it is most commonly fasten'd there, but not always, because the *Orum* for a while being loose in the Cavity of the *Uterus*, may be tumbled to this or the other part, and where ever it fixes, there it is joyn'd to the Womb by the *Placenta*.

Number.

When there is but one *Fætus* in the Womb, it is but one; but if there be Twins, then according to Dr. *Wharton*, &c. are there two *Placenta*, either distinct in shape, or if they appear in the shape of one, then are they separated by a Membrane one from the other; and a particular rope of Umbilical vessels is inserted into each from each *Fætus*. But Dr. *Needham* affirms, that there is generally but one *Placenta* even when there are two or more *Fætus*. Nor does that line that seems to divide the *Placenta* from one another, really
do

do so. For the Vessels of the right-hand *Fœtus* extend beyond this line to the left side of the *Placenta*; and on the contrary, 'tis but seldom, says he, that the *Placentæ* are multiplied according to the number of the *Embryo's*.

It grows not out of the Womb originally, but *Origine*, its first rudiments appear like a woolly substance on the outside of the outer Membrane that invests the *Embryo* (called *Chorion*) about the eighth or ninth Week, upon which in a short while a red, carnos and soft substance grows, but unequally and in little knobs, and then it presently thereby sticks to the Womb, and is very conspicuous about the twelfth or thirteenth Week. Till now the *Fœtus* is encreased and nourished wholly by the apposition of the crystalline or albugineous liquor wherein it swims loose in the inner Membrane (called *Amnios*) having no *Vasa umbilicalia* formed, by which to receive any thing from the *Placenta*. But when it waxes bigger and begins to need more nourishment, the extremities of the Umbilical vessels begin to grow out of the Navel by little and little, and are extended towards this *Placenta*, that out of it, as Plants by their Roots out of the Earth, they may draw a more firm nutritive juice, and carry it to the *Fœtus*. But of this more in the 33^d. Chapter.

It has *Vessels* from a double *Origine*, some from the Womb, and some from the *Chorion* immediately, but mediately from the *Fœtus*. The former are of four kinds, Arteries, Veins, Nerves and Lympheducts: all which though they be very large and conspicuous in the Womb, and are so even in that very place where the *Placenta* is joyned to it: yet they send but the smallest Capillaries into the *Placenta* it self, and are dispersed only through that side of it that is next the

the Womb. Those that come from the *Chorion* are Arteries and Veins, and Dr. *Wharton* supposes also Lympheducts. The Arteries and Veins that come from the Womb spring from the Hypogastricks, and also that branch of the Spermaticks that is inserted into the bottom of the Womb. Those that come from the *Chorion* are the Umbilical vessels of the *Fœtus*. Of the use of both the one and the other we shall speak in Chap. 33. when we come to discourse how the *Fœtus* is nourished, as also of the use of the *Placenta* it self, of which we shall only observe this further here; That after it is joyned to the Womb, it sticks most firmly to it for the first months, as unripe Fruit do to the Tree: But as the *Fœtus* becomes bigger, and riper, and nearer to the birth, by so much the more easily will it part from the Womb; and at length like to ripe Fruit, after the Child is born, it falls off from the Womb, and makes part of the After-birth.

Acetabula.

It was an old tradition continued for many hundred years, that the *Placenta* adheres to the Womb by certain parts called *Cotyledones* or *Acetabula*. That there are such in some Creatures it is certain; Dr. *Needham* says, they are only properly so called in Sheep and Goats, in whom being with young the Uterine glands are hollow like a Saucer or an Acorn-cup; and are adapted to the little Prominences (or *Digituli*) of the *Placentula* that grow on the *Chorion*, (though *Diemerbroeck* say, that on the contrary the *Placentulae* are hollow, (and so are truly the *Acetabula*) and the Uterine glands protuberant) and doubts not but these names were first given by those that dissected these kind of Creatures; and were afterwards applied in following ages to other Animals: So that no wonder there have been

been so great contests even about the signification of the word *Cotyledon*, (which is the Greek word for the Herb *Umbilicus Veneris* or Navelwort) and what that was that was so called in the several Creatures that were said to have them. But because such Controversies are now obsolete, and that 'tis generally confessed that Women have them not, we shall not in this Epitome run out into needless Disputes; but only observe one singular Opinion of *Diemerbroeck*, who ascribes *Cotyledones* to Women. He thinks that each Woman (unless she go with Twins) has but one *Cotyledon*, and that the fore-said *Placenta uterina* is it. And indeed it must be confessed that it resembles much the shape of that from which the *Cotyledones* have their name; and therefore seeing he formed this Opinion to defend our great Master *Hippocrates*, who had ascribed them to Women, (that is, as *Diemerbroeck* expounds it, one *Cotyledon* to one Woman) we shall not oppose it, but confess it to be, if not true, yet both ingenious and ingenuous.

C H A P. XXXII.

*Of the Membranes involving the Fœtus, and
of the Humours and Air contained in them.*

NEXT to the *Placenta* follow the two *Membranes* that involve the whole *Fœtus*, *Chorion* the outer, and *Amnios* the inner: betwixt which two, after the *Fœtus* is perfectly formed, *Dr. Needham*, &c. affirms there is a third, *viz. Allantoides*, which in Women likewise includes the whole *Fœtus* *. Of each of these in their order, with the *liquors* they contain.

* *Needh.*
de forma-
to fœtu,

lib. 2. 59.

Chorion.

The outmost *Membrane* is called *Chorion*, it is pretty thick, smooth on the inside, but without, something unequal or rough, and in that part of it that adheres to the *Placenta* and by it to the Womb, has very many Vessels which spring from the *Placenta* it self, and from the Umbilical vessels. Those which spring from the *Placenta* are dispersed through it before the *fœtus* is shaped, (as *Diemerbroeck* affirms;) but the latter not till the Navel rope is grown out to a just length, at which time they enter it and intermix with the former, and from this Membrane are inserted into the *Placenta* to which the *Chorion* adheres. It is but one even when the Mother goes with Twins: for, as in a Nut that has two Kernels in it, they are both included within the same Shell, but are each invested in their proper Membrane; so Twins are both inclosed in one *Chorion*, but have each a particular *Aminios*. It invests the *Ovum* originally, which *Ovum* being brought into the Womb, and becoming a Conception, this Membrane imbibes the moisture that bedews the Womb plentifully at that time. For whiles the Conception is loose in the Womb; and has no Vessels that reach out of it self, nor is fasten'd to any part, it must have its increase after the same manner as the Egg has in Hens, "which while it is in the *racemus* or knot, consists of no other substance but Yelk; and when it drops off from thence and descends through the *infundibulum*, it receives no alteration; but when it comes into the Cells of the process of the *Uterus*, it begins to gather a White, although it stick to no part of the *Uterus*, nor has any Umbilical Vessel; but (says my Author; the immortal
"Harvey)

" *Harvey* *) as the Eggs of Fishes and Frogs do * Dege-
 " without, procure to themselves Whites out of nerat. A-
 " the water ; or as Beans, Pease, and other Pulse, nimal. Ex-
 " and Bread-corn being steep'd in moisture swell, ercit. 9. de
 " and thence acquire aliment for the bud that is Ovi.
 " springing out of them : so in like manner out
 " of the *plicæ* or wrinkles of the Womb (as out
 " of a Dug or Womb-cake) does there an albu-
 " gineous moisture flow, whence the Yelk (by
 " that vegetative and innate heat, and faculty
 " wherewith it is endued) gathers and concocts
 " its White. And therefore in those *plicæ* and
 " the hollow of the Womb does there plentifully
 " abound a liquor resembling the taste of the
 " White. And thus the Yelk descending by lit-
 " tle and little is encompassed with a White, till
 " at last in the outmost *Uterus* having assumed
 " Membranes and a Shell, it is perfected.) Thus
 I say does the *Chorion* imbibe that albugineous
 liquor that from the first Conception encreases
 daily in it, (and transudes through the *Amnios*
 wherein the *Embryo* swims) till the Umbilical
 vessels and the *Placenta* are formed, from and
 through which the *Fœtus* may receive nourish-
 ment.

This liquor that it imbibes I take to be nutriti- Its liquor.
 ous juice that ouzes into the Cavity of the *Uterus*
 out of the capillary orifices of the Hypogastrick
 and Spermatick Arteries, and is of the same na-
 ture with that which afterwards is separated in
 the *Placenta* and carried to the *Fœtus* by the Um-
 bilical Vein, and with that also which abounds
 in the *Amnios* even till the Birth. For the pla-
 stick or vegetative vertue is only in the *Ovum* it
 self, and the augmentation that the first Linea-
 ments of the *Embryo* receive ; is only by apposi-
 tion of this nutritious albugineous juice. But this

Q

Membrane

Membrane *Chorion* by that time the Umbilical Vessels and *Placenta* are formed, is grown so dense and compact, that it is not capable of imbibing more; but that which at this time is in it, does in small time transude into the *Amnios*, and so it self becomes empty, and gives way to the encrease of the *Allantoides*, (which thenceforward begins to appear) whose liquor augments daily as the *Fætus* grows nearer and nearer to the birth. This is my conjecture, which I submit to the censure of the learned.

Amnios. The *Amnios* is the inmost Membrane that immediately contains the *Fætus*. It is not knit to the *Chorion* in any place save where the Umbilical Vessels pass through them both into the *Placenta*. It is very thin, soft, smooth, and pellucid, and encompasses the *fætus* very loosely. It has Vessels from the same origins as the *Chorion*. It is something of an oval shape.

Its liquor. Before the *Ovum* be impregnated, this Membrane contains a limpid liquor, which after the impregnation is that out of which the *Embryo* is formed. In it resides the plastick power, and the matter also out of which the first lineaments of the *Embryo* are drawn. But because its liquor is so very little, there transudes through this Membrane presently part of that nutritious albuminous humour that is contained in the *Chorion*, which it had imbibed out of the *Uterus*, as was but even now shewn. And by the juxta-apposition or addition of this humour to the undiscernible rudiments of the *Embryo*, it receives its encrease. But though the *Amnios* have its additional nutritious liquor at first only by transfusion; yet when the Umbilical Vessels and the *Placenta* are formed, it receives it after another manner.

For

For then this liquor being separated from the Mother's Arteries by the *Placenta*, and imbibed by the Umbilical Vein of the *fœtus*, it passes directly to its heart, from whence being driven, a great part of it, down to the *Aorta*, it is sent forth again by the Umbilical Arteries, out of whose Capillaries dispersed plentifully through the *Amnios* it issues into its Cavity, even as far more gross and viscid juices in taking a purge (or sometimes critically) ouze into the Intestins out of the small mouths of the Arteries; though indeed it be here by the intervention of Glands, which 'tis hoped the Curious will sometime discover also in the *Amnios*.

There are some that think they have observed *Venæ lactææ* to come directly to the *Placenta*, and that out of it (as out of the Glands in the Mesentery) there arise others that convey the Chyle into the *Amnios*: and this indeed were a plausible Opinion, if it were grounded on any certain or frequent Observation of such Lactæals; and were not rather invented to avoid some difficulties with which the former Opinion seems to be pressed.

Note, that though the liquor contained in both the *Chorion* and *Amnios* be in colour and consistence very like the *serum* of the blood; yet it differs so much from the nature of that, that being held over the Fire in a Spoon, it will not coagulate; as the *serum* will.

A third *Membrane* which invests the whole *fœtus* (according to Dr. Needham, &c.) is that called *Allantoides*, though improperly as to Women. For it is so called from its likeness to a Pudding (*ἀλλανξίτης*, *farcimen*) which indeed it does resemble in Sheep, Does, Hogs, &c. but in Women, as also in Mares, it has the same Fi-

Allantoides.

gure as the *Chorion* and *Amnios*, betwixt which it is placed in their whole circumference, (as the said observing Anatomist affirms.) Now though it must be supposed that this as well as the other two, is originally in the *Ovum*, yet there is no appearance of it till after the Umbilical vessels and *Placenta* are formed, and the albugineous liquor (so often mentioned) ceases to be imbibed by the *Chorion* out of the *Uterus*. But as soon as the *fœtus* begins to be nourished by the Umbilical vessels, and the *Urachus* is permeable, then presently this Membrane begins to shew it self, containing a very thin liquor, which is the Urine of the *fœtus* brought into it by the *Urachus* from its Bladder; and with which it is filled daily more and more till the birth. It is very thin, smooth, soft, and yet dense. It may be known from the *Chorion* and *Amnios* by this, that they have numerous Vessels dispersed through them, but this has not the least visible Vein or Artery. It is very hard to separate the *Chorion* from it, because when it appears, the *Chorion* becomes void of all liquor, and so claps close to it. But towards the birth of the *fœtus* it becomes so turgid with Urine, that the *Amnios* (immediately containing the *fœtus*) swims in it, and so may most easily be distinguished and separated from it.

Its liquor.

The liquor that it contains is (as has been said) the Urine of the *fœtus* brought hither by the *Urachus*. For as soon as the *fœtus* is perfectly formed, its Kidneys must needs perform their office of separating the *Serum* from the blood, for otherwise it would be affected with an *Anasarca*, or other sort of Dropsie. I say, the *Serum* is separated in the Kidneys, and glides down from thence into the Bladder, in which it is found pretty plentiful when the *fœtus* is five or six Months

Months old. Now it flows not out of the Bladder by its neck, because at that time the Sphincter is too contracted and narrow, and if it should pass that way, it would mix with that nutritious juice in which the *fœtus* swims in the *Amnios*, and wherewith, by taking it in by its Mouth, it is partly nourished, and so would defile and corrupt it, and make it unfit for nourishment. Nature therefore has provided it another exit by the *Uraebus* inserted into the bottom of the Bladder; which though after the Child is born it grow solid like a Ligament, like as the *Vena umbilicalis* does, yet while the *fœtus* is in the Womb it is always pervious, and conveys the Urine into the *Allantoides* that is placed betwixt the *Chorion* and *Amnios*, where it is collected and preserved till the birth.

Besides these three Membranes, Dr. Needham has observed a fourth in Cats, Bitches, and Conies, containing a nutritious liquor; but I shall not here describe the same, because it is not my design to be so copious as to treat of any part in other Animals, whereto there is not something answerable in an humane body.

Note, that according to Dr. Needham's Observation, these Membranes are not only filled with liquors, but contain a pretty deal of air. For if one take a Secundine up in his hand, he says, one may observe in the uppermost part of the Membranes a pretty distance between the Membrane and the liquor contained in it. And he thinks that the *Vagitus uterini*, (of which he gives an instance not to be denied) are a clear demonstration, that there is air, at least in the *Amnios*. And the piping of Chickens in the Egg, before either the Shell or the Membranes be broke, evince the same. And seeing there ap-

Air in the
Mem-
branes.

pears no way whereby the wind should enter from without, he is of opinion that it is bred in the Membranes themselves; that is, that the liquor which is pretty spirituous, and fitted for the fermentation and concoction of the *Fœtus*, and therefore well replenisht with air, may well be supposed to yield plenty of exhalations; by the interposition whereof the Membranes, being separated from the humours, are kept so lax, that they may yield to all the motions both of the *Fœtus* and of the Mother, without danger of bursting. For this air does not so distend the Membrane, but that by blowing, it will widen to thrice as large a dimension as the liquor it contains, and the air too, do extend it.

C H A P. XXXIII.

Of the Umbilical Vessels, and of the nourishing of the Fœtus.

The Navel-string.

HAVING opened the Membranes that enwrap the *Fœtus*, there appears the *Navel-string* or *Rope*, which is membranous, wreath'd and unequal, arising out of the middle of the *Abdomen*, (*viz.* the Navel) and reaching to the Womb-liver or *Placenta*, of a notable length, being three spans or half an Ell long, and as thick as ones Finger. It was convenient to be so long and lax, that when the *Fœtus* in the Womb grows strong, it might not break it by its sprawling and tumbling about; and after it is born, the *Secundines* or After-birth might be drawn out the better by it.

The

The way that it passes from the Navel to the *Placenta* is very unconstant; for sometimes it goes up on the right hand to the Neck, which having encompassed, it descends to the *Placenta*, and sometime it goes on the left hand up to the Neck, &c. Sometimes it comes not to the Neck at all, but goes first a little up towards its Breast, and then turns round its Back, and from thence passes to the *Placenta*. *Its situation.*

The *Vessels* contained in this string (and which are enwrapped in a common Coat called *Funiculus* or *Intestinulum*) are four, one Vein, two Arteries and the *Urachus*. *Vessels.*

The *Vein* is larger than the Arteries, and arises from the Liver of the *fœtus*, (*viz.* out of its Fissure) by the Trunk of the *Vena portæ* (of which it seems to be but a branch) and from thence passing out of the Navel, it runs along the *Funiculus* to the *Placenta*, into which it is implanted by innumerable roots; but in its passage it sends some little twigs into the *Amnios*. *Vein.*

The Ancients that thought the *Fœtus* was nourished by the Mother's blood onely, taught the sole use of this Vein to be, to carry blood from the *Placenta* to it: and since it has been found out and believed that it is nourished also (if not onely) by Chyle or *Succus nutritius*, some have continued the same office to this Vein, and think that the Chyle is brought by Lacteal Vessels arising out of the *Placenta*, as (they say) it was brought thither by the Mother's Lacteals. And indeed if any certain discovery had been made of these same *Lacteæ*, we should have embraced this Opinion as the most probable. But we are not to form Hypotheses out of rational Notions onely, but much rather from what appears to the Eyes of the Dissector. We do affirm there- *Its use.*

fore, that the Umbilical Vein serves for conveying to the *fœtus* the nutritious juice separated in the *Placenta* from the Mother's Arteries. How this separation is made, and how it is first of all turned into blood, we shall consider by and by.

But together with this juice there returns so much of the Arterial blood (that comes from the *fœtus*) as is not spent upon the nourishment of the *Placenta*, or of the *Chorion* and *Amnios*. Which liquors thus mixed, though by the Umbilical Vein they are poured into the *Sinus* of the *Porta*, yet are they not distributed through the Liver by the usual Channels thereof only, but by the Venal duct (described before, Ch. 12.) is the greatest part thereof conveyed in a direct course and full stream into the *Cava* above the Liver.

Besides this Vein which is common to all Creatures, there have been observed in Whelps and Coneys (and may perhaps in others) two small Veins more than, arising from the fourth involving Membrane peculiar to them, pass directly from the *Umbilicus* to the Mesentery of the *fœtus*, as the other great one does to its Liver; which may strengthen the Opinion, that the Chyle or *Succus nutritius* is brought to the *fœtus* by the Umbilical Vein (or Veins.) These Veins Dr. Needham calls *Omphalo-mesentericæ*.

Arteries.

In the *Funiculus* are included also two *Arteries*, which are not both of them together so big as the Vein. They spring out of the inner Iliacal branches of the great Artery; (Dr. Needham judges them to be derived immediately from the extremity of the *Aorta* before its division) and passing by the sides of the Bladder they rise up to the Navel, out of which they are conducted to the *Placenta* in the same common cover with the Vein and *Utrachus*, with which they are twined and wreathed

wreathed not unlike a Rope. I say, they are inserted into the *Placenta*, and with the Vein make a most admirable Net-like texture. but there is one branch of each of them which is manifestly inserted into the *Amnios*. Dr. *Harvey* says, the Vein is conspicuous a pretty while before these Arteries appear.

In the Creatures mention'd in the foregoing Paragraph, there are besides these Arteries, others answering to and accompanying the Veins called *Omphalo-mesenterica*, above-mention'd.

Blood and Vital Spirit are not carried by them *Their use*, from the Mother to the *Fœtus*, as many, from *Galen*, have taught; but on the contrary, Spirituous blood is driven from the *Fœtus*, by the beating of its Heart, to the *Placenta* and the Membranes for their refection and nourishment; from which what blood remains, circulates back again in the Umbilical Vein together with the *Succus nutritius* afresh imbibed by its capillaries dispersed in the *Placenta*. But besides Arterial blood, there flows out of the Navel by them part of the *Succus nutritius* that was imported by the Umbilical Vein, namely that of it which is more crass and terrene, which by one circulation through the Heart (or it may be many) could not be changed into blood: this part I say flows out by these Arteries, which by their branches that are dispersed through the *Amnios* disimboque it by their little mouths into it; for what use, shall be declared presently.

And here I shall transcribe a material Objection with the Answer to it, out of *Diemerbroeck*. *How the vessels pass through the Membranes.*
Obj. "How can these Vessels (Vein and Arteries) when they have grown from the Belly of the *Fœtus* to that length as to reach the Membranes, penetrate and pass through them to the *Placenta*?"

“ *Placenta?* *Ans.* This is done in the same
 “ manner as the roots of Herbs, Shrubs and Trees
 “ penetrate into the hard Ground, yea often into
 “ thick Planks, Walls and Stones, (which water
 “ cannot enter) and root themselves firmly in
 “ them. For just so the first sharp-pointed and
 “ most fine ends of the Umbilical Vessels in-
 “ sinuate themselves by little and little into the
 “ pores of the Membranes, (for the figuration
 “ of those pores are fitted for their entrance)
 “ and pass through them, and yet the liquors
 “ contained in these Membranes cannot flow out
 “ by them: and when those Vessels inhering in
 “ the pores grow more out into length, by lit-
 “ tle and little the said pores are more and more
 “ widened, (according to the encrease of the
 “ Vessels) and are inseparably united unto, and
 “ grow in them.

Urachus.

The fourth Umbilical Vessel is the *Urachus* or
 Urinary Vessel. This is a small, membranous,
 round Pipe, endued with a very strait Cavity,
 arising from the bottom of the Bladder up to the
 Navel, out of which it passes along within the
 common cover, and opens into the *Allantoides*.
 It is more apparently pervious in many of the
 larger Brutes than it is in Man, in whom some
 have denied it any Cavity: but that it is hollow
 in him, is confirmed by many Histories of per-
 sons adult, who having the ordinary Urinary pas-
 sage along the *Penis* stopt, the passage in this Ves-
 sel has been unlocked, and they have made wa-
 ter by the Navel, which could not have been
 imagin'd to have happen'd, if it had been origi-
 nally a Ligament without any *Meatus*. *Bartholin*
 and others have affirmed that the *Urachus* in Men
 reaches no further than the Navel; How then
 comes that humour into the *Allantoides* that has
 perfectly

perfectly the same taste with the Urine in the Bladder? But their Errour sprung from hence, that they thought a humane *Fœtus* had no *Allantoides*, and that humour that is found in it, they thought had been contained in the *Chorion*. But this is in short refuted above, but more fully and accurately by Dr. *Needham*, *lib. de formato Fœtu*, cap. 3. As to the perviousness of the *Urachus* I shall add this further, That in Abortions of five or six Months old, the Bladder of the *Embryo* is always full of Urine, out of which if in the following Months it should not be emptied by the *Urachus*, the Bladder would soon burst, seeing there is daily some *Serum* separated from the blood in the Kidneys, and sent to the Bladder; and the more the *Fœtus* encreases, the more must needs be separated. Yea Dr. *Needham* affirms, that one may either press the liquor contained in the *Allantoides* by the *Urachus* into the Bladder, or with a Pipe blow wind out of the Bladder by the same way into the *Allantoides*.

Its use has been sufficiently declared in the preceding Paragraph; as also above, when we delivered the use of the *Allantoides*, which we shall not repeat.

These four Vessels (as has been said above) Funiculus. have one common cover, which also keeps each of them from touching other. It is called: *Intestinulum* and *Funiculus* (by which it with its Vessels is sometimes understood.) It is membranous, round and hollow, indifferent thick, consisting of a double coat, (the inner from the *Peritonæum*, and the outer from the *Panniculus carnosus*.) Sometimes it self only is wreath'd about like a Rope, the Vessels included in it running streight along

along its Cavity ; and sometimes they are wreathed together with it.

Its knots. It has several *knots* upon it here and there, which Dr. *Wharton* thinks to be *Papilla* or little Glands through which the lacteal (or nutritious juice) distill out of the capacity of the *Funiculus* into the Cavity of the *Amnios*. I cannot tell whether this be so or no ; but that use that docting Midwives make of them , to guess by their number how many Children more the Mother shall have , and by their colour , whether those Children shall be Male or Female, is most ridiculous and superstitious.

How to tie the Navel-string and cut it off. When the Infant is born, this Navel-rope is used to be tyed, about one or two fingers breadth from the Navel, with a strong thread cast about it several times , and then about two or three fingers breadth beyond the Ligature to be cut off. What is not cut off, is suffered to remain till it drop off of its own accord. Which the longer or shorter while it is a doing, the longer or shorter liv'd, Women prophesie the Children will be.

Of the nutrition of the Foetus. There have been great Disputes among both Philosophers and Physicians, with what , and by what way the *fœtus* is nourished. Some affirm by blood only, and that received by the Umbilical Vein ; others by Chyle only , received in by the Mouth : each of which are in an extrem. The truth is, according to the different degrees of perfection that an *Ovum* passes from a Conception to a *fœtus* ready for the birth , it is nourished diversly.

First, by apposition. For first, as soon as an *Ovum* impregnated is descended into the Womb, it presently imbibes through its outer Membrane some of that albugineous

neous liquor that at this time plentifully bedews the internal Superficies of the *Uterus*; so that as soon as the first Lineaments of an *Embryo* begin to be drawn out of that humour contained in the *Amnios*, they presently receive encrease by the apposition of the said liquor filtrated out of the *Chorion* through the *Amnios* into its Cavity. And this same liquor that thus encreaseth the first rudiments of the *Embryo*, is called by Dr. *Harvey Colliquamentum*. That this way of nutrition or augmentation of the *Embryo* is possible, need not be doubted by him that considers that the *fœtus* of a Sow have no other possible way of being nourished till she is near half gone with Pig: "for even till then, saith Dr. *Needham*, the *Chorion* cleaves not to the Womb, but look as many *fœtus* as there are, there are so many Eggs as it were without Shells, neither sticking to the Womb nor to one other; but when one opens the Matrix, they all tumble out of their own accord. There are no Glandules, no *Placenta*. But the *Chorion* which is soft and porous, does like a Sponge imbibe or suck up the serous liquor that sweats out of the inmost Membrane of the *Uterus*, to be afterwards swallowed by the Veins, (I suppose he means the Mouths of the Umbilical Vein, after the said Vein is so perfectly formed as to receive it.) But of this more in the beginning of the foregoing Chapter.

But when the parts of the *Embryo* begin to be a little more perfect, and the *Chorion* becomes so dense that not any more of the said liquor is imbibed by it, the Umbilical Vessels begin to be formed, and to extend to the side of the *Amnios*, which they penetrate, and both the Vein and Arteries pass also through the *Allantoides* and *Chorion*,

2. By the
Umbilical
Vein.

tion, and are implanted into the *Placenta*, that at this time, first gathering upon the *Chorion* joyns it to the *Uterus*. And now the Hypogastrick and Spermatick Arteries, that before spued out the nutritious juice into the Cavity of the *Uterus*, open by their orifices into the *Placenta*, where (whether by meer percolation through it, or by some sort of fermentation also, I will not determine, but) they deposite the said juice, which is absorbed by the Umbilical Vein, and by it conveyed first to the Liver, then to the Heart of the *fœtus*, where the thinner and more spiritous part of it is turned into blood. But the more gross and terrene part of it descending by the *Aorta* enters the Umbilical Arteries, and by those branches of them that run through the *Amnios*, is discharged into its Cavity. They that will laugh at this passage of the nutritious juice, because it is made by this doctrine to choose its way, as if it were some animal or even rational Creature, let them avoid the like treatment if they can, while they deliver that the Chyle passes immediately either from the Mesentery, the *Receptaculum*, or *Ductus communis* to the *Placenta*, when a *fœtus* is in the Womb. 'Pray how should the Chyle know, or the Lacteals, by which it passes, that there is any *fœtus* in the Womb, that the one should offer to go that way, and the other give it way to go thither at that time; whereas the passage is shut at all other times? yet this my Opponents maintain. As also how comes the Chyle presently to turn its course after the *Fœtus* is born; and instead of descending to the *Uterus*, ascend to the Breasts? What mechanical cause can be assigned to these and many other the like *Phænomena*? We must therefore be content to resolve some things into the admirable

mirable and unintelligible disposal of our wise Creator.

But there lies another Objection against this Opinion, Because it allows none of the Mother's blood to be received by the *Fœtus* through the Umbilical Vein, but only *Succus nutritius*; how should Blood be first bred in the *Fœtus*, seeing it has Blood before the Liver or Heart, or any other part that conduce to Sanguification, are in a capacity to perform their office?

I confess it is inexplicable by me how Blood should be made so soon; but that it may be and is made, out of the *Succus nutritius* or *Colliquamentum*, without the mixture of any from the Mother, is apparent from the most accurate Observations of Dr. *Harvey*, concerning the order of the generation of the parts in a Chicken, (which from first to last receives nothing from the Hen.) Says he, * "there appears at the * De ge-
 "very first a red leaping *Punctum* or Speck, a nerat. A-
 "beating Bladder, and Fibres drawn from thence nimal Ex-
 "containing Blood in them. And as much as ercit. 51.
 "one can discern by accurate inspection, Blood is
 "made, before the leaping Speck is formed;
 "and the same is endued with vital heat, before
 "it is stirred by the Pulse: and as the pulsation
 "begins in the Blood and from it; so at length
 "at the point of death it ends in it.—And
 "because the beating Bladder and the sanguine-
 "ous Fibres that are produced from it appear
 "first of all; I should think it consentaneous to
 "reason, that the Blood be before its receptacles;
 "namely the content before its container; and
 "that this is made for the sake of the other.
 He confesses it to be a *Paradox*, that Blood should
 be made and moved, and endued with vital spirit
 before any sanguifying or motive Organs are in
 being;

* Exerc.
cit. 57.

being; and that the Body should be nourished and increased, before the Organs appointed for concoction (namely the Stomach and Bowels) are formed: but neither of these are greater Paradoxes than that there should be sense and motion in the *Fœtus* before the Brain is composed; and yet, says he, "the *Fœtus* moves, contracts, and stretches out it self, when there is "nothing conspicuous for a Brain but clear water. I say; if all these unlikely things do certainly come to pass in an Egg, that has nothing to set the vegetative, or vital principle thereof on work, but the warmth of the Hen that sits upon it; why should we think it strange that nutritious juice impregnated with the vital spirits of the arterial Blood, with which it circulated through the Mother's Heart (it may be more than once) should be turned into Blood in an humane *Fœtus* (fostered with such kindly warmth in the Womb) though it neither receive any humour under the form of Blood from the Mother, nor have it self as yet any Organs of sanguification so perfect as to perform their office? But to proceed.

3. By the
mouth.

The grosser nutritious juice being deposited by the Umbilical Arteries in the *Amnios*, as soon as the Mouth, Gullet, and Stomach, &c. are formed so perfectly that the *Fœtus* can swallow, it sucks in some of the said juice, which descending into the Stomach and Intestins is received by the *Vena lactea*, as in adult Persons.

That the *Fœtus* is nourished this way, *Diemerbroeck* evinces by these Reasons.

" 1. Because the Stomach of the *Fœtus* is never
" empty, but is found possess of a milky whitish
" liquor; and such like is contained even in its
" Mouth.

" 2. Because

“ 2. Because there are *Fæces* contained in the Intestins, (which Philosophers call *Meconium*) which the Infant as soon as 'tis born voids by stool. Without doubt these are the excrements of some aliment taken in by the Mouth.

“ 3. Because the Stomach could not presently after the birth perform the function of concoction, if it had not at all been accustomed to it in the Womb.

His fourth Reason, supposing the *Fœtus* to be nourished in part by the Mother's Blood, I shall not recite, because I think that to be an erroneous Opinion, as I think to make appear by and by.

“ 5. Because the Infant as soon as it is born knows how to suck the Breast, which it could not be supposed to be so dextrous at, if while it remained in the Womb it had taken nothing by suction.

“ 6. Because many Infants as soon as they are born, before they have sucked any Breast, or taken any thing by the Mouth, vomit up a milky aliment: which therefore must needs be received into their Stomach in the Womb. This he gives an instance of in one of his own Children.

These Arguments I think sufficient to prove what they are alledged for; but when he would afterwards prove that the *Fœtus* is also nourished by the Mother's Blood conveyed by the Umbilical Vein, I think his Reasons are invalid. For he says it must be so, *first*, because the said Vein is implanted into the *Placenta*; (but this is but begging the Question, for 'tis necessary it should be implanted into it, though it receive nothing from it but nutritious juice) *Secondly*, because of the great quantity of Blood that will issue out of

The Fœtus is not nourished at all by the Mother's blood.

the Umbilical Vein, if one tye the Navel-rope, and then open the said Vein betwixt the Ligature and *Placenta*: for he says there will flow out four times as much Blood as could be supposed to be contained in the small Arteries on that side the Ligature next the *Placenta*. I answer, that first one would be well satisfied that the Ligature was made so strait, that there could no Blood pass through it from the *Fœtus* to the *Placenta*. And secondly, it cannot exactly be guessed how much Blood may be contained in the *Fœtus's* Arteries in the *Placenta*, so as that one should be certain that there does four times more flow out by the Vein. But lastly, suppose there do four times as much more blood issue out of the Vein as is contained in the *Fœtus's* Arteries that are on that side the Ligature next the *Placenta*, and this blood come from the Dam's Hypogastrick and Spermatick Arteries; I say there will not only four times, but forty times as much issue therefrom, for all the blood of the Dam might then be drawn out this way. Wherefore I think this Experiment makes much more against his Opinion than for it. His *third* Reason is the necessity of it; because as the *fœtus* encreases, it needs much aliment, and its weak Bowels can concoct but little, it must therefore have some purer aliment, and which is already concocted (he means blood) to nourish it, and by its commixture to help forward the changing the aliment received by the Mouth into blood. *Answ.* This reason himself invalidates in the next Paragraph, * where he confesses that the *Fœtus* in the Womb is nourished in the same manner as the Chicken in an Egg, which receives encrease first by the *inner White* (as he distinguishes) by way of apposition; Secondly, it receives nourishment in

* Anat.
corp.hum.
p. 367.

in by the mouth from the *outer* White, and at the same time its Umbilical Vessels enter the Yelk (to draw nourishment from thence) which, he says indeed, resembles the Mother's blood; but seeing it has not the least form of blood, why would it not be more plausibly said that it is instead of the *Succus nutritius* that the *Fœtus* in viviparous Animals receives by the Navel-vein? And seeing these several Liquors are turned, part of them, into blood in a Chicken, without any of the Hen's blood to ferment them (as he speaks;) why should not the same power be granted to the vegetative or animal soul of the *Fœtus* in the Womb, without any assistance from the Mother's blood? To which I shall add another Argument (out of Dr. *Harvey*) taken from Cæsarean births, when living Infants are cut out of the Mother's Womb, after she is dead. For if it had its life and heat from the Mother's blood; surely it should dye as soon as she at least, if not sooner: for when death approaches, the subordinate parts do languish and grow cold before the principal; and therefore the Heart fails last of all. Wherefore the blood of the *Fœtus* would first lose its heat, and become unfit for its office, if it were derived from the Mother's Womb; seeing her Womb is destitute of all vital heat, before her Heart. But enough of this.

But some may object, if the *Fœtus* be nourished by none of the Mother's blood, why should her *Menses* be stopt all or most of the while she is with Child? To which I answer, that 'tis for the same reason that Nurses that give suck commonly want them also; for as in Nurses the chyle passes in a great proportion to the Breasts, whereby the blood being defrauded of its due

The reason why Women with Child want their Menses.

and wonted share does not encrease to that degree as to need to be lessened by the flowing of the *Menses*; so in Women with Child, there is so great a quantity of the *Succus nutritius* (which is only Chyle a little refined and impregnated with vital spirit) that passes to the *Placenta* by the *Hypogastrick* and *Spermatick* Arteries for the nourishment of the *Fœtus*, that unless the Mother be very sanguine, her *Menses* intermit after the first or second Month.

I shall conclude therefore, that the *Fœtus* is nourished three several ways, but only by one humour: first by apposition of it whiles it is yet an imperfect *Embryo* and has not the *Umbilical Vessels* formed; but after these are perfected, it then receives the same nutritious juice by the *Umbilical Vein*, the more spirituous and thin part whereof it transmutes into blood, and sends forth the grosser part by the *Umbilical Artery* into the *Amnios*, which the *Fœtus* sucks in at its Mouth, (after the parts of the Mouth, the *Gula*, *Ventricle*, &c. are formed sufficiently for such an action) and undergoing a new concoction in its Stomach is received out of the Intestins by the *Vene lactææ*, as is done after the birth.

Observation The now generally received opinion of the *Fœtus*'s receiving nourishment by the mouth in the latter months, may, besides the reasons above-recited from *Diemerbroeck*, be further confirmed by the following Observation. About November 1696. I was sent for to an Infant that could not swallow. The Child seem'd very desirous of food, and took what was offer'd it in a Spoon with greediness; but when it went to swallow it, it was like to be choaked, and what should have gone down returned by the mouth and nose, and it fell into a struggling convulsive-sort of fit upon it.

It

It was very fleshy and large, and was two dayes old when I came to it; but the next day died. The Parents being willing to have it opened, I took two Physicians and a Surgeon with me. Opening the *Abdomen* first, the Guts had some of the *Meconium* remaining still in them, though the Child had gone two or three times to stool. The Stomach had in it a pretty deal of a slimy sort of Liquor, (or gelly rather) somewhat like pretty thick (strained) water-gruel. I shall not mention any observations upon other parts in the *Abdomen*, as being not to our present purpose.

Then we cut open the *Thorax*, and taking out the Gullet (with the Wind-pipe, Lungs, &c.) continued to the Stomach, we blew by a pipe down the Gullet, but found no passage for the wind into the Stomach. Then we made a slit in the Stomach, and put a pipe into its upper orifice, and blowing, we found the wind had a vent, but not by the top of the Gullet. Then we carefully slit open the back-side of the Gullet from the stomach upwards, and when we were gone a little above half way towards the *pharynx*, we found it hollow no further. Then we began to slit it open from the *pharynx* downwards, and it was hollow till within an inch of the other slit, and in the imperforated part it was narrower than in the hollowed. This *Isthmus* (as it were) did not seem ever to have been hollow, for in the bottom of the upper, and the top of the lower cavity there was not the least print of any such thing, but the parts were here as smooth as the bottom of an acorn-cup.

Then searching what way the wind had passed when we blew from the stomach upwards, we found an oval hole (half an inch long) on the fore-side of the gullet opening into the *aspera ar-*

teria a little above its first division, just under the lower part of the *Isthmus* above-mentioned.

Now, I say, this is a plain confirmation of the *fœtus's* being nourished by the mouth; for the *Gula* being impervious, Nature had formed this hole in the wind-pipe and gullet, for the liquor contained in the *amnios* to pass into the Stomach, which it might do without prejudice, or any fear of choking, in the Womb, while the Child breathed not: but when it was born and came to breathe, there could be no longer any passage this way, and so the Infant was necessarily famished.

C H A P. XXXIV.

What parts of a Fœtus in the Womb differ from those of an adult person.

HAVING delivered the History of the *Fœtus*, we will only further shew in what Parts a *Fœtus* in the Womb differs from an adult person. And this we cannot do more exactly than in the manner that *Dicmerbroeck* has reckon'd them, whom therefore we shall here translate, with little alteration.

This diversity, he saith, consists in the difference of magnitude, figure, situation, number, use, colour, cavity, hardness, motion, excrements, and strength of the Parts.

Now this diversity is conspicuous either in the whole Body, or in the several Ventracles, or in the Limbs.

There is considerable in the whole Body,

1. The littleness of all the parts.
2. The reddish colour of the whole.

3. The

3. The softness of the Bones ; whereof many are as yet gristly and flexible, and that by so much the more, by how much the *foetus* is further from maturity.

In the Head there are several differences. As

1. The Head in respect to the proportion of the rest of the Body is bigger, and the shape of the Face less comely.

2. The bones of the Skull are softer, and the Crown is not covered with bone, but only with a Membrane.

3. The bone of the Forehead is divided, as also that of the under-Jaw : and the *Os cuneiforme* is divided into four.

4. The bone of the *Occiput* or hinder part of the Head is distinguisht into three, four or five bones.

5. The Brain is softer and more fluid, and the Nerves very soft.

6. The bones that serve the sense of Hearing are wonderfully hard and big.

7. The Teeth lye hid in the little holes of the Jaw-bone.

8. There is no less diversity in the *Thorax*. For,

1. The Dugs swell, and out of them in Infants new-born whether Male or Female, a fecous Milk issues forth sometimes of its own accord, sometimes with a light pressure : yet there are no Glandules very conspicuous, but there is some fashion of a Nipple.

2. The *Vertebra* of the Back want their spinous processes, and are each one made of three distinct Bones, whose mutual concurrence form that hole whereby the spinal marrow descends.

3. The Heart is remarkably big, and its *Auricle* large.

4. There are two unions of the greater Vessels, that are not conspicuous in adult persons : viz.
1. The *Foramen ovale*, by which there is a passage open out of the *Cava* into the *Vena pulmonaris*, just as each of them are opening the first into the right Ventricle, and the latter into the left Ventricle of the Heart. And this *Foramen* just as it opens into the *Vena pulmonaris* has a Valve that hinders any thing from returning out of the said Vein into the *Foramen*. 2. The *Cavalis arteriosus*, which two fingers breadth from the *basis* of the Heart joins the *Arteria pulmonaris* to the *Aorta*. It has a pretty large Cavity, and ascends a little obliquely from the said Artery to the *Aorta*, into which it conveys the blood that was driven into the pulmonary Artery out of the right Ventricle of the Heart, so that it never comes in the left Ventricle; even as that blood that is sent out of the left Ventricle into the *Aorta*, never came in the right, (except a little that is returned from the nutrition of the Lungs) but passed immediately into it out of the *Vena cava* by the *Foramen ovale*. So that the blood passes not through both the Ventricles as it does after the *fœtus* is born; for then it must have had its course through the Lungs, which it cannot have, because they are now very dense and lye idle and unmoved. Yea they are so dense and heavy, that if one throw them into water they will sink; whereas if the *fœtus* be but born and take only half a dozen breaths, they become so spongy and light that they will swim. Which (by the way) may be of good use to discover whether those Infants that are killed by Whores, and which they commonly affirm were still-born, were really so or no. For if they were still-born, the Lungs will sink;

sink ; but if alive, (so as to breath never so little a while) they will swim.

4. The Gland *Thymus* is notably large , and consists as it were of three Glands.

In the lower belly there are these differences.

1. The Umbilical Vessels go out of the *Abdomen*.

2. The Stomach is narrower , yet not empty, but pretty full of a whitish liquor.

3. The Caul is hardly discernible, being almost like a Spider's-web.

4. The Guts are seven times longer (or more) than the Body.

5. In the small Guts the Excrements are pituitous and yellow, but in the thick somewhat hard and blackish, sometimes greenish : the *Cæcum* is larger than usual, and often filled with *feces*.

6. The Liver is very large, filling not only the right Hypochondre, but extends it self into the left side, and covers all the upper part of the Stomach. It has a passage now more than in the adult called *Canalis venosus*, which arising out of the *Sinus* of the *Porta* carries the greatest part of what is brought by the Umbilical Vein directly and in a full stream into the *Cava* above the Liver ; but as soon as the Infant is born, and nothing comes any longer by the said Vein, this *Canalis* presently closes, as the Vein it self turns to a Ligament ; as also do the *Urachus* and the two Umbilical Arteries.

7. The Spleen is small.

8. The Gall-bladder is full of yellow or green Choler.

9. The Sweet-bread is very large and white.

10. The Kidneys are bigger and unequal in their superficies, and look as if they were compounded of a collection of very many Glandules.

11. The

11. The *Renes succenturiati* are exceeding large; they do not only border upon the Kidneys, as in the adult, but lye upon them and embrace their upper part with a large *Sinus* as it were.

12. The Ureters are wide, and the Bladder distended with Urine.

13. In Females the *Uterus* is depressed, the *Tuba* long, and the *Testes* very large.

The difference in the Limbs consists,

1. In the tenderness and softness of the Bones.

2. The little bones of the Wrist and Instep are gristly and not firmly joyned together.

CHAP. XXXV.

Of the Birth.

THE *Fœtus* swimming in the liquor of the *Amnios*, and the Navel-rope being so long, it must needs have scope enough to change its situation, and that is the reason that Anatomists differ so much about it. But according to Doctor *Harvey* its usual posture is thus.

*The posture
of the Fœtus
in the
Womb.*

“ Its Knees are drawn up to the Belly, its Legs bending backwards, its Feet across, and its Hands lifted up to its Head, one of which it holds to the Temple or Ear, the other to the Cheek; where there are white spots on the Skin as if it had been rubb’d upon. The backbone turns round, the Head hanging down towards its Knees. Its Head is upwards, and its Face commonly towards the Mother’s Back.

*At its
birth.*

But towards the birth (sometimes a Week or two before) it alters its situation, and tumbles down

down with its Head to the neck of the Womb, with its Feet upwards. Then the Womb also settles downward and its orifice relaxes and opens. And the *Fætus* being now ill at ease sprawls and moves it self this way and that way, whereby it tears the Membranes wherein it is included, so that the Waters (as they call them) flow into the *Vagina*, which they make slippery for the easier egress of the Infant: though sometimes the Membranes burst not, but come forth whole, (as they do commonly in Brutes.) At the same time the neighbouring parts are loosened and become fit for distention: the joyntings of the *Os sacrum* and *Pecten* with the *Coxendix*, as also of the *Ossa pubis* are so relaxed, that they yield very much to the passage of the *Fætus*. And its motion gives that disturbance to the *Uterus*, that presently the animal spirits are sent plentifully by the Nerves to its constrictory Fibres, and the Muscles of the *Abdomen*, which all contracting together, very strongly expel the *Fætus*, which (in the most natural birth) goes with the Head foremost: and if the Feet or any other part (besides the Head) do offer it self first, the travail is always more painful and dangerous.

The several sorts of Creatures have sundry terms of going with young: The stated and most usual time of Women is nine Months; though some bring forth some Weeks sooner, and others later. But when it is given out that perfect and sprightly Infants are born at seven Months end; it is either to hide the faults of some new-married Woman, or from the mistake of the ignorant Mother. As also when sometimes the Mother has affirmed her self to go eleven Months or upwards, it is either through mistake, or to keep fast some fair Estate, when the pretended Father's
dead

dead without an Heir, for which the cunning Widow plays an after-game.

*The reason
of the
birth.*

Divers reasons are given why the *Fœtus* at the stated time of birth is impatient of staying any longer in the Womb. As the narrowness of the place, the corruption of its aliment, or the defect of it, the too great redundance of excrements in the *Fœtus*, and the necessity of ventilation or breathing. All these are plausibly defended by their several Authors. But without blaming ingenious Men for exercising their Wits on such a Subject, we choose however rather to be content with resolving all into the wise disposal of the great Creatour, whose Power and Wisdom were not more eminent in creating Man at first out of the Dust of the Earth, than out of those principles and in that method whereby he is produced in ordinary generation.

Tab. X.

Fig. 1. Representeth the usual situation of the *Fœtus* in the Womb.

A *Its Head hanging down forwards, so that its Nose is hid betwixt its Knees.*

BB *Its Buttocks, to which its Heels close.*

CC *Its Arms.*

D *The Umbilical rope passing by its Neck, and wound round over its Forehead.*

Fig. II. Sheweth the *Fœtus* taken out of the Womb, and as yet tyed to the *Placenta*, the Umbilical Vessels being separated at their rise.

AAA *The Abdomen opened.*

B *The Liver of the Fœtus.*

C *The*

Fig. 2.



Fig. 1.

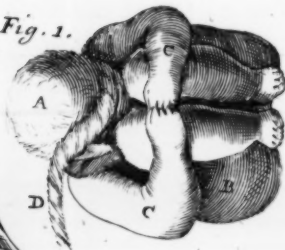


Fig. 3.



C *The Urinary Bladder.*

DD *The Intestins.*

E *The Umbilical Vein.*

FF *The Umbilical Arteries.*

G *The Urachus.*

H *The Umbilical Vessels united and invested in their common Coat.*

I *The Funiculus umbilicalis reaching to the Placenta.*

KKKK *The Veins and Arteries dispersed through the Placenta.*

LLL *The Placenta of the Womb.*

Fig. III. *Sheweth an Embryo in its just dimension, (communicated to me by Dr. E. Tyson.)*

a *Its wide Mouth with the Tongue in it.*

b *The Umbilical rope.*

c *The Thighs and Legs, with the Coccyx d appearing like a Tail.*

The End of the First Book.

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The Second Book.

OF THE
MIDDLE CAVITY,
CALLED
THORAX.

CHAP. I.

*Of the common containing parts of the Thorax
or Breast.*

Hitherto of the lowest Cavity or *Abdomen*, *The Breast*.
and of the parts contained in it, whether appointed for *Chylification* (and in some respect for *Sanguification*) or for *Procreation*.
Now it followeth that we describe the middle Cavity, called *Thorax*, which containeth the Organs of Respiration, and those that elaborate the Blood and Vital Spirits, with the trunks of the Vessels whereby these are distributed into all the parts of the Body, for their refection, and the preservation of their natural heat.

This Cavity is bounded above by the *Clavicle* - *Its bounds*.
la or *Chanel-bones*, below by the *Diaphragm* or *Midriff*, (whereby it is severed from the *Abdomen*;) in the fore-part by the *Breast-bone* and *Cartilages*;

Cartilages ; in the Sides by the Ribs ; behind by the *Vertebrae* of the back.

Figure.

The *figure* of it is in a manner Oval, somewhat flat before and behind , whereas in Beasts it is somewhat sharp : So that only Man lieth on his Back.

Parts.

The *parts* whereof it is composed , are either containing, or contained. The *parts containing* are either common, or proper.

The common containing parts.

The *common containing parts* are in number five, viz. *Cuticula*, *Cutis*, *Pinguedo*, *Membrana carnosa*, and the common Membrane of the Muscles. Of which having at large discoursed in Book I. Ch. 3. when we treated of the *common containing parts* of the lower Belly, we shall not here repeat what is there delivered, but pass on to the *proper*.

CHAP. II.

Of the proper containing parts ; and first, of the Dugs.

The proper containing parts.

THE *proper containing parts* are either *external*, or *internal*. The *external* are in number Three, the Breast, the Muscles, and the Bones. The *internal proper* containing parts are three in like manner ; the *Pleura*, the *Mediastinum*, and the Diaphragm.

The Dugs.

Dugs are granted to both Sexes, and are seated in the middle of the *Thorax* , on each side one, upon the pectoral Muscle that draweth the Shoulder forwards.

1. Of Men.

In Men they are framed of the *Cutis*, the *Membrana carnosa*, Fat , and the Nipple , and serve only for beauty, and are called *Mammillae*.

In Women, besides these parts, they have remarkable Vessels, Glandules, and Pipes to contain the Milk separated by the Glandules, and are called *Mammæ*. 2. of Women.

They differ much as to their bigness in several Women, and in the same Woman in regard of age and other circumstances: for before they have their *Menses*, and when they are very old, they bunch out but very little. And in the middle or flower of their age, when they give suck, or are with Child, they are bigger than at other times. Their bigness.

They are made up of many glandulous bodies of a different bigness, and are not of one continued glandulous substance, (as Dr. *Wharton* affirmeth, *lib. de Gland. p. 236.*) There is one Gland in the middle just under the Nipple that is bigger than the rest. The spaces between the Glands are filled up with fat, and there are abundance of Vessels that go from one to another. They are all inclosed by the *Membrana carnosæ*, and make up as it were an half globe. They are whiter of substance in Women than in Brutes. Through these Glands the Milk is separated from the Blood, being nothing but the Chyle issuing out of the left Ventricle of the Heart with the Blood, (to which it is not as yet assimilated) and driven hither along the Thorack Arteries. Unless we will admit *Venæ lactææ* to come hither, which Opinion we shall examine afterwards. Glands.

Upon the middle great Gland standeth the *Papilla*. *Papilla* or Nipple, which is round and of a spongy substance, covered with a very thin Skin, and has many little holes in it for the Milk to distil out by, when the Child sucketh it. It is of an exquisite sense, and resembles something the

Glans of a Man's *Penis*, in that by handling or sucking, it becomes erect or stiff, being otherwise commonly flabby. It is red in Virgins, livid in those that give suck, and blackish in old Women. All the *Tubuli lactiferi* or Milk-conduits end in it.

Its bigness. It differs in *bigness*, being as big in some as a Mulberry, in others as a Raspberry, in others less: when Women give suck, it is longer than at other times.

Use. Its *use* is to be like a Pipe or Tunnel, through which the Child (taking it in its Mouth) may suck the Milk out of the Breast: And it is of exquisite sense, that the Milk passing through it may cause a kind of titillation, whereby Mothers and Nurses may take the greater delight and pleasure to suckle their Infants.

Areola. There is a little circle that surrounds it called *Areola*, which in Virgins is pale and knotty; in those that are with Child or give suck, brown: and in old Women, black.

Their Vessels. The Breasts have all sorts of Vessels, Veins, Arteries, Nerves, Lympheducts, which are common to them with other parts; and *Tubuli lactiferi* proper to themselves, and according to some, *Venæ lacteæ*. Of all these in order.

Veins. The *Veins* are of two sorts, for some are *external*, some *internal*. The *external* spring from the *Axillar* branch, and run only under the Skin which covereth the Breasts, and are called *Thoracica superiores*, or the uppermost Breast-veins. And these are they that look so blue in the Breasts of fine-skin'd Women. The *internal*, called *Mammariae*, spring from the *Rami subclavii*: They are in number two, on each side one. These enter in among the Glands of the *Mamma*, where they send forth a great many branches;

but

but descending thence by the *Mucronata cartilago*, they pass out of the Breast, and go downward under the *Musculi Recti*. When they are come almost to the Umbilical region, they are said to be joyned by sundry inosculation with the *Venæ epigastricæ*, which meet them there; though most late Anatomists deny any such inosculation.

These *Venæ epigastricæ* spring from the external *Ramus iliacus*, and by a streight way pass upward under the aforesaid Muscles. And from the internal branch of the said *Ramus* spring the *Venæ hypogastricæ*, which are inserted into the neck and bottom of the Matrix. Of which in Book I. when we treated of the Womb.

They have the same number of *Arteries* as *Arteries* *Veins*, and of the same denomination, viz. *Arteria thoracica superiores* which are sent forth from the *Axillar*, and *Arteria mammaria* in like manner which spring from the Subclavian, and from the Breasts descend to about the Navel. Whither when they are come, they are said (but erroneously) to be united by inosculation with the *Arteria Epigastricæ* ascending. This inosculation being rejected, principally, because it is opposite to the circulation of the blood, seeing the blood in the descending Arteries runs a course direct contrary to that which is contained in the ascending; Dr. *Higbmore* suggests, "that the Mammary Arteries do not inosculate with the Epigastrick Arteries, but with the Epigastrick Veins, and accordingly the Mammary Veins with the Epigastrick Arteries: Whence supposing (according to the old Opinion) that Milk is made of blood, he thinks he has found a ready way whereby the blood may pass to the Womb in pregnant Women for the nourishment

" rishment of the *Fœtus*, and whereby it may
 " ascend to the Breasts in Nurſes. For by the
 " Epigaſtrick Arteries, he ſays, blood is derived
 " from the Iliack branches, and conſequently
 " from the Womb to the Mammary Veins, ſo
 " that that blood which in thoſe that do not give
 " ſuck, or are not with Child, uſes to ſtagnate
 " about the Veſſels of the Womb, or to be eva-
 " cuated by the *Menſes*, does in thoſe that give
 " ſuck aſcend by the Epigaſtrick Arteries to the
 " Breasts, which it cauſes to ſwell, and is turn-
 " ned into Milk: And on the contrary, when
 " the Child is weaned, that blood which uſed
 " to be carried to the Breasts by the Mammary
 " and Epigaſtrick Arteries, is conveyed to the
 " Womb, and evacuated monthly.] And for the
 confirmation of his Opinion, in his Tab. 17. he
 gives a Scheme of ſuch inoſculation, as if he had
 really obſerved it in his tracing theſe Veſſels.
 But not to mention, that it is contrary to truth,
 that Milk is made of blood; later Anatomists,
 have wholly rejected any Anaſtomofis of Veins
 and Arteries with one another; ſo that his Hy-
 potheſis which is built thereupon, falls to the
 ground. As for the true uſe of both Veins and
 Arteries, that ſhall be ſhewn by and by when we
 come to the uſe of the Breasts.

Nerves.

They have *Nerves* (according to *Spigelius*)
 from the fourth Vertebral pair of the *Thorax*,
 which about the middle of the Rib, perforating
 the Intercostal Muſcle, is divided into four bran-
 ches, which are ſent afterward to the pectoral
 Muſcle, and ſo into the Breasts, the thickeſt paſ-
 ſing to the Nipple. Dr. *Needham* ſays, that they
 have ſeveral Nerves from the Axillary: And
 ſuppoſes from their many Nerves, that ſome
 ſpirituous juice is brought unto the Breasts by
 them,

them, which being mixt with the nutritious mass endows it with a nutritive vertue; or perhaps it supplies a ferment for the separation thereof from the blood. But I believe they serve only for the more exquisite sensation, that Nurses may take the greater delight in giving their Children suck.

They have very many *Lympheducts*. Dr. Whar-^{Lymph-}ton saith, they are very conspicuous and nume-^{ducts.}rous in the *Ubera* of Cows, but one can hardly trace them into the *Parenchyma*. Wherefore (saith he) 'tis likely that they carry back all the exhalations resolved into sweat by help of the Membranes——which they rather minister to than to the *Parenchyma*. But this is contrary to the now received Opinion, that the *Lympheducts* receive their *Lympha* only by the mediation of Glands.

Besides these four sorts of Vessels that are ^{Tubuli} common to them with most other parts of the ^{Lactiferi.} Body; they have proper to themselves certain *lactiferous* (or milk-carrying) *Pipes*, which are the Store-houses wherein the Milk is reserved, and through which as by Conduits it flows to the Nipple when the Child sucks. *Bartholin* has observed ten or more of them, full of Milk in Women giving suck, with their outer ends encompassing the *Papilla* circular-wise, each of which as they pass further into the Breasts, are divided into sundry branches, which end in the Mammary Glands (above spoken of) from whence they bring the Milk, and discharge it through the pores of the *Papilla*.

The several branches of these *Tubuli* amongst ^{Vene la-} the Glands many do take for true ^{lacte-} *Lacteals*, and therefore do believe that there are some *Vene lactea* that conduct the Chyle directly to the

Mammæ. But from whence those Lacteals have their Origin, is not agreed among the Defenders of that Opinion. Some affirm them to rise from the Stomach, some from the *Receptaculum chyli*, some from the *Ductus thoracicus*, and some from the *Womb*. The truth is, it is no wonder they should not agree concerning their rise, seeing the Opinion is grounded more upon rational conjecture, than ocular discovery; though some of each of these Opinions have pretended it. For, as was said in the former Book (Chap. 32.) discoursing of the *Venæ lacteæ* their being said to convey the liquor into the *Amnios*, That that were a plausible Opinion, if such could be demonstrated by Anatomy; so we may say as to their conveying the Chyle to the Breasts, where it comes to be called Milk. But with all due respect and deference to the Espousers of this Hypothesis, (such as the most learned Sir George Ent, Caspar Martianus, Diemerbroeck, &c.) we must crave leave to dissent therefrom (with Steno, Dr. Wharton, Dr. Needham, &c.) till there shall be observed more certain footsteps of such Vessels.

Ductus
adiposi.

From the great quantity of Fat that is collected in the Breast *Malpighius* contends for another sort of Vessel besides all the foregoing, namely *Ductus adiposi*; and believes that the fat here has a nobler use than to fill up the Interstices of the Glands so as to make the Breasts round and plump, namely that therefrom issues at least all the buttery part of the milk. It cannot be denied but that Fat and Butter are very much of the same nature: but it seems not so probable, that Nature should separate the oily or fatty particles from the Chyle, to the end only that they may be mixed with the same again, and so issue
under

under one form out of the body ; but granting that the same matter out of which fat is generated, is an ingredient in the milky mass, I am inclin'd to believe that both the serous, caseous, and butyrous particles of the milk continue in one another's embraces through all the ways by which they pass from their first entrance into the *Lactea* to their exit by the *Papilla*.

The use of the Breasts in Women is to prepare *The use of* or separate Milk for the nourishment of the Child. *the Mam-* Which how it is done, we shall shew in as few *mæ.* words as may be.

It was an old Opinion that Milk was made of blood sent from the Womb by the Epigastrick Vessels ascending, and as was thought inosculating with those branches of the *Mammariae* that descend towards the Navel. But as later Anatomists have found those Anastomoses only imaginary (invented to serve an Hypothesis ;) so it is generally denied that blood either sent from the Womb, or from wheresoever, is the true matter out of which Milk is made. For not to mention (which yet is very considerable) that it is incredible that the Mother could every day endure the loss of so much blood (suppose a pound and half) as the Child sucks daily Milk from the Breasts ; I think the Argument urged by Dr. *Wharton* may satisfy any man, viz. " Nature does nothing in vain ; she goes not forward and backward by the same path. But if she make blood of Chyle (*which is certain*) and then make Chyle of blood again, she goes so. For Chyle is a sort of Milk, as appears by the opening of the Lacteal veins. If therefore that Chyle be first excocted into blood, and then return again to the nature of Milk, Nature should certainly frustrate her first work.] We shall not there-

fore spend further time to refute so improbable (and now obsolete) an Opinion; but shall avow, that Chyle is the true matter out of which Milk is made, which is done after this manner.

*How Milk
is made.*

The Chyle being received into the common receptacle from the *Vena lactea* of the Mesentery, ascends up by the *Ductus Thoracicus*, and by it is conveyed into the subclavian Veins, where it is mixed with the blood, and from whence it is circulated with it through the ventricles of the Heart. And when it comes out of the left ventricle by the *Aorta*, a good part of it (as yet not assimilated to the blood) is sent to the Breasts by the Mammary and Thoracick Arteries, whose Capillaries are inserted into the Glands through which it is strained or filtrated into the *Tubuli lactiferi*, even as the *Serum* of the blood is separated from it by the Glands of the Kidneys into their *Tubuli* or *Siphons*. And as those *Siphons* of the Kidneys carry the *Serum* into the *Pelvis*, so do these of the *Mamma*, the Milk into the common Duct of the Nipple. As for the blood that came along with the Chyle to the Glands, that returns back again into the Subclavian and Axillar Veins, and so to the Heart.

Besides this matter of the Milk (*viz.* Chyle) Dr. *Wharton* (suitable to his Hypothesis of the *Succus nutritius* of the Nerves) thinks that the Nerves contribute their share, which he calls *Spermatick*, for the nourishment and encrease of the *Spermatick* parts of the Child. But if it should be supposed that the Nerves have such *Succus* in them (which we do not believe) what weakness must it needs induce upon the Mother to have so much of it (with the Animal Spirits) daily drain'd out of them? whereas we see that

many

many Women are more chearful and healthful when they give suck, than at other times. We cannot therefore consent to that Opinion.

And here a most difficult Question may arise, why the Chyle (whether it be brought by some *Venæ lactææ*, or by the Arteries) flows only to the Breasts at some certain times, and not always, seeing the Vessels that carry it are not obliterated, nor it self exhausted.

They that taught, that the Milk was made of blood, and that that blood was derived from the Womb by the Hypogastrick vessels into the Epigastrick, which latter they believed to inosculate with the Mammary; these I say deriving the Milk from the Menstrual blood as its matter out of which it is made, thought that the stopping of the *Menses* (as commonly happens to Nurses, unless very plethorick) occasioned the regurgitation of the blood by the said Vessels up to the Breasts, where so free a vent was found for it, after it was first changed into Milk by their Glandules. They assigned the same blood for the nourishment of the *Fœtus* in the Womb, and thought that after the birth it ascended up to the Breasts. But having in the former Book (Ch. 33.) shewn that the *Fœtus* is not nourished at all by the Mother's blood, as also in this Chapter that Milk is not made of it; we need not (though it were easie to) shew how ill this Hypothesis would satisfy the Question, if blood should be supposed the matter out of which Milk is made. And indeed it is far easier to invalidate the Reasons that have been urged for it, than to draw any from the new that are more satisfactory. So that as above in (Book I.) discoursing of the manner and matter of the nourishing the *Fœtus* in the Womb, we scrupled not to expose our
selves

selves to the Smiles of our so over-sagacious *Virtuosi*, in resolving all into the wise disposal of the Creatour ; so we shall not be ashamed to profess our (I think invincible) ignorance here also, without giving this Question any other Resolution, than that it is so , because Providence has order'd it so to be. However we will not omit to give *Diemerbroeck's* Opinion , which if it cannot satisfie , may for its ingeniousness delight.

“ The cause of it (says he) is a *strong imagination*, or an intense and often thinking of Milk, Breasts, and their Suction, which worketh wonderful things in our Bodies : not indeed simply of it self, but by mediation of the appetitive power, or of the passions of the Mind, which induce various motions on the Spirits and Humours. So the imagination and thinking of a great danger maketh a man tremble, fall, be cold, fall into a swoon, yea hath sometimes turn'd his Hair grey in a short time : The imagination of a joyful matter causeth heat and animosity of the body ; thinking on a shameful thing, or a view of it, causeth blushing ; thinking on a terrible thing, paleness ; on a sad thing, cold. Lustful thoughts make the Body hot, relax the strict Genitals of Women, erect the *Penis*, and do so open the seminary ways that are otherwise invisible, that Seed issueth out of its own accord in involuntary or nocturnal pollution. The same intense imagination (*adds he*) and a desirous cogitation of suckling the Infant, is the Cause that the Chyliferous Vessels (*by which he means Venæ lactæe properly so called*) “ are loosened and “ opened towards the Breasts, especially if some “ outward Causes tending that way favour and “ further

“ further incite that strong imagination, as wanton handling of the Breasts, the moving of the *Fætus* in the Womb, the sucking of the *Papilla*, &c. For according to the different influx of the Animal Spirits, the parts are sometimes straitned, sometimes relaxed, as every one knows; and according to that different constriction or relaxation the blood and other impelled humours, flow sometimes more, sometimes less into the parts; and sometimes beget heat, softness, redness; sometimes constriction, cold, and paleness. Amongst these impelled humours is the Chyle, &c.——] To confirm this Opinion, he gives several Instances wherein nothing but imagination could move the Chyle to tend to the Breasts. His first is that known Story of *Santorellus*; “ That a poor man’s Wife dying, and not having means enough to hire a Nurse for the Infant she had left behind her, he used, (to still it a little) often to lay it to his Paps, (without doubt (says *Diemerbroeck*) with a great desire to yield it some Milk) and so at length by that intense and continual thought, and often repeated sucking of the *Papilla*, his Breasts afforded Milk enough for the suckling the Infant. (Which by the way seems to make much against his Opinion of the Chyle’s being conveyed to the *Mammæ* by the *Venæ lacteæ*; for seeing Men according to Nature give no suck, to what purpose should *Venæ lacteæ* be distributed to their *Mammillæ*? and yet here is an instance of a man giving suck, and therefore the Chyle is more likely to be brought by the Arteries, which Men have as well as Women; unless we will grant that force to imagination, to make *Venæ lacteæ*, as well as to send the Chyle by them,

them, which would be an equal force of imagination to imagine. But to proceed.) He tells another Story of an old Woman that came to give suck, and he delivers it with such Circumstances as may create a belief of the truth of it.

“At *Vyanen* a Town not far from us (*viz.* “from *Utrecht*, in which Province it is) about “thirty years ago there was an Hostess that kept “the Bore’s-head Inn without the Gate, who “was brought to Bed a little after her Husband’s “death, and died in Child-bed, or very soon after, leaving a healthful Child behind her: “and having left very little Estate, her Mother “whose name was *Joan Vuytuyt*, being also poor “and not able to put it out to Nurse, yet had “such pity on her Daughters Child, as to undertake to Nurse it, and she was now three-score and six years old. Now having sometimes used, with the greatest commiseration, “to hold it to her Breasts when it cried, and offered it the Nipple to suck; by that strong “imagination, and desirous cogitation of nursing “the Infant, her Breasts begun to give Milk, and “that in a few days so plentifully, as was abundantly sufficient to feed the Child, so that it “had scarce any need of other sustenance; and “so, to the admiration of all, the Infant was “well nourished with the Milk of this old Woman, whose Breasts for many years had been “wither’d and flabby, but now became plump “and full like a young Woman’s. There are “many still alive in that City that remember the “thing very well.] I confess the Story is very odd, but whether to be resolv’d into the force of imagination, I leave the Curious to meditate. However he very plausibly answers several Objections that may be made against it, which it will

will be worth the while for the Latin Reader to peruse in his *Anat. corp. human. lib. 2. cap. 2. p. 409, 411, &c.*

The two other *external* proper containing parts of the *Thorax* are the *Muscles* and the *Bones*. But of these we shall omit the description here, having thought it more convenient to treat of all the *Muscles*, and all the *Bones* of the whole Body in two distinct Books, *viz.* of the *Muscles* in the *fifth*, and of the *Bones* in the *sixth*: And as for these of the *Thorax* in particular, the *Muscles* are described in Chap 15. of B. V. and the *Bones* in Chap. 11, 12, 13. of B. VI.

C H A P. III.

*Of the internal proper containing Parts,
viz. the Pleura, Mediastinum and
Diaphragm.*

THE *internal* proper containing parts are in number three, the *Pleura*, the *Mediastinum*, (with the *Thymus* growing to it) and the *Diaphragm*.

The *Pleura* hath its denomination from the *Pleura*. Ribs which it cloaths on their inside, (for a Rib is in Greek called *πλευρά*) and so it may be termed in English, the *Costal membrane*.

It is membranous, white, thin, and hard, resembling the *Peritonæum*, and lining all the Cavity of the *Thorax*. *Its substance.*

Spigelius de human. corp. fabr. lib. 9. cap. 3. will have it to be thicker and stronger than the *Peritonæum*,

tonæum, contrary to the Opinion of *Riolanus*, who affirmeth the *Peritonæum* to be the thicker and stronger, because it is appointed for sustaining the weight of the Guts.

Paris.

It consists of a double Membrane, of which the inner, or that next the cavity, is thickest. This is smooth on its inside, and bedewed with a waterish humour, that the Lungs might play against it without any prejudice. Sometimes on one side, and sometimes on both, it sends forth (on its inside) certain nervous Fibres, (even in healthful persons) which being inserted into the investing Membrane of the Lungs do so fix them in their place, as to hinder that liberty of ascent and descent in respiration which is natural to them, and yet many times without any notable injury to their breathing. Though sometimes (as *Spigelius* has observed) they tye the Lungs so very close to the sides, as to cause a continual and incurable *Dyspnæa*. As to that waterish humour that bedews the inside of this Membrane, it seems to proceed from vapours raised from the blood, and condensed by the (comparative) coldness of this Membrane. The outer Membrane is thinner, and rough on its outer surface, that it might cleave the more firmly to the Ribs and Muscles by the intervention of their proper membrane.

Figure.

As for its figure; without, it is arched; within, hollow; above it is narrower, below broader, being chiefly widened side-ways.

Holes.

Above, it is perforated in six or seven places, to give way to the *Vena cava* descending, and the *Aorta* ascending, the *Gula*, the Wind-pipe, Lacteals, Lympheducts and Nerves. Below, where it covereth the Midriff, it is perforated in three places, to give way to the *Vena cava* ascending, and the *Aorta* descending, as also to the *Gula*.

It is said to have its *rise* from the Membranes *Rise.* covering the *Spinalis medulla*; however, it adheres very close to the *Vertebrae* of the Back, from whence it comes forward on each hand by the sides to the Breast-bone, under which the Membranes of each side are joyned together, and so becoming double it goes back again streight from the middle of the Breast to the Back, dividing the cavity of the *Thorax* into two parts, like a partition-wall, and one Lobe of the Lungs from the other: and this is called *Mediastinum*, of which by and by.

Its *Veins* spring from the superiour Intercoastal *Veins.* branch, and from the *Vena sine pari.*

The *Arteries* in like manner proceed from the *Arteries.* superiour Intercoastals, (which arise from the Subclavian) and these descend to about the fourth Rib, below which it has its Arteries from the hinder part of the *Aorta* descending.

It hath *Nerves* from twelve vertebral pair, *Nerves.* viz. from all the pairs of the *Thorax*: for from betwixt each of the twelve *Vertebrae* of the Back there springs a pair of Nerves, and each is immediately divided into the *fore- and hinder-branches*: The *fore-branches* are they which serve the Intercoastal Muscles, external and internal, and also the *Pleura*: as for the *hinder*, they are bestowed upon the Muscles which lye on the Back, &c.

The Veins and Arteries according to *Spigelius* run between the two Membranes of the *Pleura*, and therefore he thinks that when an inflammation of the *Pleura* (called a *Pleurisie*) imposthumates, the matter is rather gathered betwixt its Membranes, than betwixt the Intercoastal muscles and it.

Of the Mediaſtinum. The second *internal* proper containing part is the *Mediaſtinum*; ſo called becauſe it ſtandeth in the middle of the Breast, and divideth its cavity into two partitions, *viz.* a right and left.

Its riſe. It ſpringeth from the Membranes of the *Pleura* meeting at the *Sternum*; (as was ſaid before;) ſo that at its riſe it conſiſts of four Membranes, becauſe the *Pleura*, of the duplicature whereof it is made, conſiſts of two. But as the *Mediaſtinum* tends from the *Sternum* through the middle of the *Thorax* towards the Back, its duplicated Membranes are ſo ſevered, that the Heart with its *Pericardium* are contained in the cavity that is formed by their ſeparation. Yet when they arrive near the Back, they joyn one to another again as cloſe as they did at the Breast, though they preſently part again, (ſaith *Diemerbroeck*) and make another narrower Cavity, but as long; for the Gullet, &c. to deſcend by. Some have formerly imagined a third Cavity at its Origin under the *Sternum*, as in particular Dr. *Higmore*, who ſays the interſtice betwixt the Membranes is large, and yet (he ſays) they are knit to one another by certain Fibres. In this Cavity, he thinks, there are thick vapours and *flatus* ſometimes contain'd, which cauſe very acute pains there, by retching the membranes and violating the fibres that knit them together. But in truth there is no ſuch Cavity, nor conſequently any ſuch vapours, or pain depending thereupon. For though indeed, if the diſſection be begun at the *Sternum*, when one has pull'd it off from the *Mediaſtinum*, one would think at firſt ſight that there were as great a diſtance betwixt the Membranes of the *Mediaſtinum*, as the *Sternum* is broad; yet if one begin the Section at the Back, and looſe the Ribs there,

there, and so come to the *Sternum*, he will see the *Pleura* doubled knit close to the *Sternum* without any Cavity.

The substance of it is like that of the *Pleura* substance, from which it springs; only where it is parted, it is thinner and softer than the *Pleura*. The outer side towards the Lungs is smooth, but the interior is rough, by reason of the fibres whereby it adheres to the *Pericardium* in some places, and by which its own two Membranes at their meeting are united. It is sometimes pretty well stored with fat, especially about its Vessels, somewhat like the Caul in the *Abdomen*.

As for its Vessels: *Veins* and *Arteries* it hath *Veins* from those called *Mammariæ internæ*, but small; *Arteries* and *Veins* besides from *Vena sine pari*.

It hath moreover one special *Vein* called *Mediastina*, which springeth from the lower side of the *Ramus subclavius*.

The *Nerves* called *Phrenici*, and *Stomachici*, *Nerves* springing from the sixth pair (Dr. Willis's eighth) descend betwixt its Membranes, and send forth small twigs into it.

Bartholin says, it has *Lympheducts*, which rising *Lympheducts* here and there in many Rivulets, enter the *ductus thoracicus* at last in one chanel. These (he says) imbibe the water that is condensed betwixt its duplicature, and convey it into the said Duct.

It hath three uses: *First*, it divideth the Breast *uses* and Lungs into two parts, that one part being wounded or any way hurt, the other might perform the office of respiration.

Secondly, It holdeth up the Heart inclosed in the *Pericardium* so, that it may not rest upon the Back-bone, when we lye upon our Back; or fall upon the Breast-bone, when we bend our selves

T

towards

towards the ground ; or touch the Ribs, when we lye upon our Sides.

Thirdly, It giveth a safe passage to the Vessels which pass by it, and holdeth up the Diaphragm so that it is not pulled too much down by the weight of the Bowels that hang by it, *viz.* the Liver and the Stomach.

Thymus. To the upper part of the *Mediastinum* at the Throat there groweth a glandulous body called *Thymus*, seated between the divisions of the Subclavian Veins and Arteries. It is a whitish, (but lightly tinctur'd with blood) soft, spongy body, (in shape resembling a Tyme-leaf, from which it has its name.) It is larger in Children and Women than in Men. In Infants it consists of three Glands, and is in substance something like the Sweet-bread ; but in adult Persons it dries up and contracts into one continued substance. It has no proper Duct whereby any thing is conveyed into any peculiar cavity, and therefore is to be reputed in the number of conglobate Glands.

Its Vessels. The Jugular *Veins* and *Arteries* pass through it as they go up to the Neck, but if they send forth any twigs into it, they are so small as not to be discovered in dissecting it. Dr. *Wharton* says, it has *Nerves* from the sixth pair (Dr. *Willis's* eighth) and from the Subclavian *Plexus*, which deposite their *Succus nutritius* in it, whose superfluous or impurer parts are separated from it in this Gland, and conveyed away by the Lympheducts, and the refined liquor is resumed by the Nerves dispersed in it, for the use of the nervous parts of the whole Body. And because he foresaw how open this Opinion, (which himself calls *seruposa sententia*) lay to the Objection, that it is very improbable that the Nerves should bring the *Suc-*

cus nutritius to this part, and after depuration should resorb it; he answers, that either the Nerves must do it, or it cannot be done at all, seeing there are no other Vessels fit for the resuming of it. But he had better have suspected his supposed office of the *Thymus*, when he saw himself so hard set to maintain it. For it is more probable that when there is found any whitish liquor in it, (as there is in Infants, and in Calves, &c.) that liquor is Chyle which is brought thither by Lacteals, and descends from thence into the Subclavian Veins; seeing if one kill a Calf about two hours after it has been plentifully suckled, the *Thymus* abounds with this juice, as *Diemerbroeck* affirms; who also denies that there are any perceptible Nerves inserted into it, but grants Lympheducts, which empty themselves into the Subclavian Vein.

Its *uses* are, first, to prop and strengthen the *Use*. divisions of the Vessels, namely of the *vena cava* and ascending *Aorta*; and secondly, to defend them from compression by the *Clavicula*; in stooping forward. In adult persons it seems to be of little other use; but in Infants, in whom it is larger, and has liquor like Chyle in it, it seems to contribute something towards the refining or depuration of it.

The third and last *internal* proper containing *The Dia-* part is the *Midriff* or *Diaphragm* (derived *and τὸ φράγμα*, *διαφραγνέν*, to distinguish, because it divides the trunk of the Body into two Ventricles, the *Abdomen* and *Thorax*.) It is also called *σελὴ* or *σέβας*, the *mind*, because when it is enflam'd or otherwise much distempered, the Mind and Senses are disturbed, through the great consent it has with the Brain, as being a very nervous part. The

Latines call it *Septum transversum* for the same reason as the Greeks call it *Diaphragma*.

Now this part being truly Muscular, and assisting respiration, we might on that account have deferred to treat of it till we come to describe the Muscles of the *Thorax*: but because it is wholly an internal part, and serves to compose the cavity of the Breast, we rather chuse to discourse of it here, and omit it in the Treatise of Muscles.

Its figure
and situa-
tion.

It is almost round, (excepting its two appendages whereby it is fastned to the *Vertebrae* of the Back and Loins) and is seated transversly or across the Body, only sloping a little backwards. It is as broad as the width of the *Thorax*, for its edges are fastned to the lower part of the *Sternum*, to the ends of the lowest Ribs, and to the lowest *Vertebra* of the *Thorax*.

Substance.

Its substance, as was said but now, is muscular, consisting of carnos and tendinous Fibres, like other Muscles. But whereas it has constantly been described by all former Anatomists as one Muscle, *Caspar Bartholin* has demonstrated it to consist of two, an upper and a lower, (or a fore and an hinder) to which discovery he was partly directed by *Steno's* Observations, who first question'd the generally supposed Fabrick of this part.

It consists
of two
Muscles.

I say it consists of two Muscles, an upper and a lower, which are thus described by the afore-said Author.

"The upper Muscle by one end, (*viz.* its head) adheres circular-wise to the Ribs, and to the Appendix of the *Sternum*; the other passeth into the *Tendon*, which makes the nervous centre of the *Diaphragm* (as they call it) and is spent on (or continued unto) the flesh of the lower Muscle, and so the whole Midriff becomes

"like

“like one digastrick or double-bellied Muscle. Nay, the said Author makes it a trigastrick one, inasmuch as he has observed (in *Oxen*) that the fore-part of the upper Muscle shoots forth a tendon to every bastard Rib on each side the *Sternum*, to which Ribs the upper part of the transverse Muscles of the lower Belly also adheres, so that he thinks they are continued one into the other. Of what use he makes this union, shall be shewed in *Book V. chap. 17. Of the Muscles of the Abdomen.*

“The lower springs from the *Vertebrae* of the Loins, and neither proceeds from the other, nor touches it but by the mediation of the Tendon, (for though the Fibres of each Muscle seem sometimes to mix a little one with another on the under side, yet that is only by mediation of each of their Tendons.) Those two *Appendices* (as they are called) of this lower Muscle whereby it adheres to the *Vertebrae*, have by all Anatomists been represented as if they were of the same length; whereas indeed they are not so, for the right is both longer than the left, and very much exceeds it in the number of carnosous and tendinous Fibres. Yea the right arises from (or rather terminates into) the first, second and third *Vertebra* of the Loins, as from so many heads; whereas the left adheres to the last, and last but one of the Back.

As to the course of the *Fibres* of both these Muscles, because they are better apprehended by the view than they can be by the description, I shall wave this latter, and content my self with exhibiting to the Eye of the Reader a Scheme of these Muscles in *Tab. 13, Fig. 2, & 3.* from the said Author.

Mem-
branes.

The upper side of the Midriff is cloathed with the *Pleura*, and its lower with the *Peritonæum*. To the upper membrane the *Mediastinum* and *Pericardium* are knit; and sometimes the lowest tips of the Lobes of the Lungs, but that connexion is preternatural.

Holes.

It is perforated on the right hand in (or near) the Nervous centre by the Trunk of *Vena cava* ascending from the Liver; and on the left hand a little more backwards, its lower Muscle in its upper or fore-part (before it is become tendinous) is perforated by the Gullet and two Stomachick Nerves springing from the *par vagum*. At which latter perforation the fabrick of the Diaphragm is remarkable; for there (as you may see in the foresaid Figures) the Fibres which are next to the upper orifice of the Stomach, run not streight as in other parts of it, but crooked like a Bow, encompassing the said orifice, and by their contraction so constringing it, that the continual motion of the Diaphragm causes no regurgitation of any thing out of the Stomach, nor is the ascent even of vapour permitted, except when it is violently burst open by belching or vomiting. In the hinder part of this lower muscle, viz. betwixt its two Appendages or productions whereby it is knit to the *Vertebra*, there descend the *Aorta*, a branch of the *Vena azygos*, and the Intercostal Nerve (distinguish'd from the *par vagum* by Dr. Willis) for the use of the parts of the *Abdomen*.

Vessels.

It has been said to have two *Arteries*, called *Phrenica*, from the *Aorta* descending, and as many *Veins* from the Trunk of *Vena cava* ascending through it. But the above-mentioned Bartholin says, that the lower muscle has peculiar Blood-vessels. "For besides those Veins that spring

"from

" from the *Cava*, (which provide for the upper
 " Muscle and middle part of the lower) this
 " lower has on each side peculiar and notable
 " ones which arise from the *Vena adiposa*, to
 " which as many Arteries answer in like manner
 " springing from the *Lumbares*, yet at a different
 " Origin from those other that accompany the
 " above-mentioned Veins that spring from the
 " *Cava*.] It has a peculiar *Nerve* which springs
 from the *brachial Nerves* with a double or triple
 Root ; namely two or three slips, proceeding
 from the aforefaid Nerves, grow into one trunk,
 which is the *Nerve* of the *Diaphragm*. The first
 and chiefest slip is produced from the second ver-
 tebral Nerve : and the trunk that is made up of
 all the three, descends down the Neck and
 through the cavity of the *Thorax* without any
 ramification as far as the Midriff, where being
 divided again into two or three slips, on each
 side it is inserted into its fleshy or muscular part.
 Now because the Intercostal pair, according to
 Dr. *Willis*, has communication with the Verte-
 bral from whence this Nerve of the Diaphragm
 springeth, yea with this Nerve it self, (for he
 says that two or three Nerves are sent from the
 cervical *Plexus* of the Intercostal into the Trunk
 it self of the Nerve of the Diaphragm) that
 learned Author very ingeniously gives a reason
 of the great consent of the Midriff with the
 Heart, Brain and Face, when a man laughs. " For,
 " *says he*, as often as the imagination is affected
 " with some pleasant or wonderful conceit, the
 " Heart would presently fain triumph (*ovare*)
 " and be lighten'd by throwing off its burthen as
 " it were : wherefore that the blood may the
 " quicklier be emptied out of its right Ventricle
 " into the Lungs, and consequently out of the

“left into the *Aorta*, the *Diaphragm* being in-
 “fligated by the Nerves that go to it from the
 “abovesaid *Plexus*, is drawn upwards with a
 “more rapid *Systole*, and often repeating its
 “jumps as it were, it bears up the Lungs, and
 “causes them the quicker and frequenter to dis-
 “charge the Air and Blood: and then inasmuch
 “as the same *Intercostal Nerve*, that communi-
 “cates below with the Nerve of the *Diaphragm*,
 “is also continued above with the *Maxillar*
 “Nerves, when a cackling is begun in the Breast,
 “the gestures of the Mouth and Face pathetical-
 “ly answer thereto.] And when the *Dia-*
 “phragm is wounded in its Nervous part, then the
 muscles of the Face suffer *Convulsions*, and the
 laughter called *Risus Sardonicus* (which is involun-
 tary) is caused. Besides the abovesaid peculiar
 Nerve, it has *secondly* small twigs from the *Sto-*
machick Nerves and *Intercostal* as they descend
 through it.

se. Its use is first to divide the *Thorax* from the
Abdomen, that noisom and impure Vapours may
 not ascend from the more ignoble parts (as the
 Guts) to offend the more noble (as the Heart,
 &c.) *Secondly*, to help the muscles of the *Abdo-*
men in excluding the Excrements, and (in Wo-
 men) the *Fœtus*. But *thirdly*, its chief Use is to
 assist respiration, in which as * *Steno* observes,
 “it self rather becomes less convex than its com-
 “pass contracted. For, says he, all the lines
 “which you please to conceive from the *Vertebra*
 “to the rest of its circumference, both when it
 “is relaxed, and when it is stretched out and be-
 “comes stiff, are crooked in some part of them,
 “looking towards the *Thorax* with their convex
 “side, and towards the *Abdomen* with their con-
 “cave. These lines they less they are extended,
 “the

DeMusc.
 & gland.
 p. 11, 12.

“ the more convex they are ; whereby the *Abdomen* is so much the larger, and the *Thorax* the
“ straiter : and the more they are contracted, by
“ so much the Surface of the Diaphragm is the
“ less convex ; whereby the *Thorax* is so much
“ the larger, and the *Abdomen* the straiter.
“ And so the bottom of the *Thorax* ; (viz. the
“ Diaphragm) in inspiration is more depressed,
“ but in expiration ascends.] Thus far *Steno*, to
whom (the often mentioned) *Bartholin* as-
sents, who says, “ that its first motion is per-
“ formed downwards, which the Lungs following,
“ draw in the Air ; and by and by it is moved
“ upward, whence the Lungs being compressed,
“ the Air with the Vapours that are mixt with
“ it are excluded. So that from a convex laxity
“ it comes to plainness (in inspiration) but is
“ not at all extended. Notwithstanding in ex-
“ piration (which *Diemerbroeck* has well obser-
“ ved) it is first of all stretched as it were with
“ violence, but it is presently relaxed again, and
“ by drawing the Ribs together with that tensi-
“ on it begins expiration with some force, and
“ then the Ribs following it, its tension pre-
“ sently ceases, and it becomes lax. Which
“ procedure *Diemerbroeck* illustrates with a pret-
“ ty and pat similitude, when he affirms it to be
“ done in the same manner as when Bells are
“ rung with long Ropes ; in which action the
“ Rope is first stretch'd with violence ; but be-
“ cause the Bell doth presently follow that vio-
“ lence, hence the Rope forthwith becomes lax,
“ until the Bell being turn'd about to the other
“ side, the Ringer do again stretch the Rope
“ with the like violence, and draw it back again.]
At length *Bartholin* concludes, “ When the Dia-
“ phragm is compressed into the *Abdomen* (in
“ inspiration)

“inspiration) the *Thorax* is elevated, otherwise
 “than others think, who suppose the depression
 “of the Diaphragm to cause a depression of the
 “*Thorax*. But in expiration the Diaphragm be-
 “ing driven upwards, the Breast is contracted;
 “the Breast being contracted presses the included
 “Air, the Air the Surface of the Lungs, that
 “the Air may be driven from the *Vesiculae* into
 “the branches of the *Trachea*, whither as soon
 “as it is come, the rings of the *Trachea* are con-
 “tracted by the intermediate Fibres, and drive
 “forth all the Air; and on this manner doth
 “Respiration proceed; all the Cells of the
 “Lungs being filled again by and by in Inspi-
 “ration.

The nature
 of its mo-
 tion.

Its motion seems to be a kind of mixt motion,
 but rather *Animal* than *Natural*; for though we
 move it in our sleep, and so it may seem natural,
 yet seeing when we awake we can stop, slacken, or
 hasten its motion as we please, it seems to be vo-
 luntary or animal.

And thus much of the parts containing, now to
 the parts contained.

CHAP. IV.

Of the Pericardium, and the Humour con-
 tained in it.

THE Parts contained are either *Viscera* or *Va-
 sa*, Bowels or Vessels.

Pericar-
 dium.

The Bowels are the *Heart* and *Lungs*. But the
 Heart being inclosed in a membranous cover,
 called *Pericardium*, we will first treat of it, in this
 Chapter.

It

It is called *Pericardium*, because it is placed *its name.*
περί τῆς καρδίας, about the Heart. It is called also
Capsula cordis, the Heart-case, and *involucrum*
the Cover, &c.

It is membranous, and encompasseth the whole *Substance*
Heart, whose shape it therefore resembles, but *and figure.*
is larger, both to grant a free motion to the
Heart, and to contain its proper liquor.

It springs at the Basis of the Heart from the *Origin.*
outer common Coats (that are borrowed of the
Pleura) of those Vessels that enter into the
Heart.

Whence it has *five holes* according to the num- *Holes.*
ber of Vessels that go in or out of the Heart. As
first one made by the ascending Trunk of the *Ca-*
va, another by the descending, both which en-
ter the right Ventricle of the Heart, from whence
there goes out *Vena arteriosa* into the Lungs,
which makes a third hole. A fourth is made by
the *Arteria venosa* entering the left Ventricle of
the Heart, and a fifth by the *Arteria magna* go-
ing out of the same.

Its outside *adheres* to the *Mediastinum* by many *Connexion.*
Fibres, and is continued to it at the basis of the
Heart, where the Vessels perforate it. Its lower
end is knit firmly to the centre or nervous part
of the Diaphragm, which (*Bartholin* says) is pecu-
liar to Men, for in all other Creatures it hangs
loose.

It has *Veins* below from the *Pbrenicæ*, above *Vessels.*
from the *Axillares*. Its Arteries are so exceeding
small, that some have almost denied it to have
any: but *Dr. Ruysch* says, " That in Bodies he
" had kept above two Years, he has shewed
" them as plain as any thing can be seen in the
" Body, and that there are very few, if any,
" membranous parts that are furnisht with great-

“er plenty of *Arteries*. See his answer to *Gaubius's* second Letter, where he describes them as derived from four or five several Origins. It receives *Nerves* from the eighth pair (heretofore reckon'd for the sixth.) Dr. *Willis* says, “It has a great many twigs of Nerves from that “*plexus* of the *par vagum* that is over against the “first or second Rib, and that it has so many for “this reason, *viz.* That seeing it is appointed “for a defence to the Heart, as often as any “offensive matter invades or besets it (self), it “may be able to contract it self and shake off its “enemy: for it is likely that *tremors* and *inordinate vibrations* of the Heart, which in truth do “manifestly differ from its *natural Pulse*, do proceed from the violent succussion of this Membrane.] *Bartholin* affirms it to have *Lympheducts* also; which is very probable, that they may absorb part of the liquor contained in it, lest it abound too much, seeing it receives continual supply: for I am not of opinion that this liquor is spued out of the *Lympheducts*, as *Steno* thinks, but that they rather imbibe it and convey it to the *Ductus thoracicus*.

It contains in it a *serous liquor*, that in healthy bodies is a little reddish, much like water wherein flesh has been wash'd. It is bred of Vapours exhaling from the Heart, which are stopt by this dense Membrane, and condensed into humour. Dr. *Lower* opposing this Opinion brings for Argument, that if it were collected this way, because it would be continually a gathering, it would soon encrease so much that this *Capsula* could not hold it. But the abovesaid *Lympheducts* absorbing what is superfluous, wash away this Objection; which if they did not, his own Opinion

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Opinion that it drops out of the Glands seated at the basis of the Heart, would be liable to the same inconvenience. For such distillation would be as continual as this condensation is supposed to be. Naturally it is not in quantity above two Spoonfuls, (though it differ much according to the temperament of the Party, the hot having a smaller, and the cold a larger quantity.) But in diseased persons it is sometimes increased to half a pound, yea to a whole pound, as *Diemerbroeck* has oft observed. This is that liquor that is supposed to have flown from the Side of our Saviour when the Souldier pierced it with a Spear, for saith the Text (John 19. 34.) *There came forth blood and water.* Sometimes Worms have been observed to breed within this bag, and such persons, when they were alive, have been subject to palpitation of the Heart, and swoonings.

The *Pericardium* is some sort of fence to the *Heart*, but it seems to be chiefly made for the sake of the liquor it contains, which serves for the moistening of the Heart, and making its Superficies slippery, that it may move more glibly.

C H A P. V.

Of the Heart, in general, and of the reason of its motion.

THE Heart (in Latin *Cor*, in Greek *καρδιον*, or *The Heart*, *καρδιον αὐτον*, to burn, because it is the source of vital heat) is the principal Bowel of the whole Body, which no perfect Animal does want, nor can long survive its Wounds. Vital spirit and natural

tural heat are communicated from it to all the parts of the Body, though they are not so much owing to its substance as to the ebullition or accension of the Blood and Chyle in it ; as shall be discoursed hereafter.

Its situation.

It is seated in the middle of the Breast, encompassed with the *Pericardium* and *Mediastinum*, its lower tip or *Mucro* bending a little to the left side. Neither its *Mucro* nor sides are knit to any place, but it hangs loose in its Case, only suspended by the Vessels that go in and out of its upper part or basis, to which the *Pericardium* adheres. Its situation in Beasts that feed upon Grass is near the middle of the whole body, reckoning from the Head to the Tail ; but in Man (and most carnivorous Animals which generally have shorter Necks than others) it is nearer the Head ; whereof the learned Dr. Lower gives an ingenious reason. " Seeing, says he, the " trajection and distribution of the blood depends wholly on the *Systole* of the Heart, and " that its liquor is not driven of its own nature " so readily into the upper parts as into Vessels " even with it, or downwards into those under it : " if the situation of the Heart had been further " from the Head, it must needs either have been " made stronger to cast out its liquor with greater force ; or else the Head would want its " due proportion of blood. But in Animals that " have a longer Neck, and which is extended " towards their Food as it were, the Heart is " seated as far from the Head as from the other " parts ; and they find no inconvenience from " it, because they feed with their Head for the " most part hanging down, and so the blood ; as " it has farther to go to their Head than in others, " so it goes a plainer and often a steeper way.

It has a firm, thick, dense *substance*, thinner *Substance*, and softer in the right side, thicker and more dense in the left, but most compact and hard at its tip; only on the left side of the tip it is thin, as consisting mostly of the concurrence of the inner and outer Membrane. Its *Parenchyma* is for the greatest part made up of musculary Fibres, so that it self may truly be reputed a Muscle.

Its *Fibres* are a few of them streight, but far *Fibres*, more oblique. Both are inserted into a Tendon that is spread over its basis under the Auricles. Part of which Tendon at the egress of the *Aorta* in some Creatures becomes bony, as in a Stag, &c. On the outer Superficies of the right Ventricle there run a few slender Fibres streight upwards, and are terminated in its basis. In which also terminate the oblique ones next under these, ascending from the left side towards the right, spiral-wise. The Fibres that lye under these, hold a clean contrary course. For they arise every where from the right side of the Heart, whence being carried obliquely towards the left, and having embraced each Ventricle of the Heart, they ascend to the basis of the left side spiral-wise as the other. But they run not all of them the whole length from the basis to the cone; for then would the Heart be as broad or thick at the lower end as the upper: but some reach not above half way, others a little further, &c. and some to the very *Apex*. The Fibres of the left Ventricle differ not from those of the right as to kind, only they are considerably stronger. Which they are for this reason, that whereas the right Ventricle only promotes the circulation of the blood through the Lungs, the left must cast it forth with that force as that it may circulate through the whole Body.

The

The curious Reader may find a most accurate description of these Fibres in Dr. *Lower's* *Treatise de Corde*, whither I refer him; for, to insist too long on such minute similar parts, would not be suitable to this Epitome of Anatomy. Though by a view of those Figures that I have borrowed of Him, their structure may be pretty plainly apprehended.

Figure. Its *shape* is like a Boy's Top (save that it is flattish behind) or a Pyramid turn'd topsie turvy; whence it is divided into its basis, which is its broader part and upper; and into its cone or *apex*, or narrower and lower part, which ends in a tip or *muco*.

Digness. It is *bigger* in Men than in other Creatures, considering the proportion of their bodies. It is lesser but more dense in hot and bold men, than in the cold and cowardly. In adult persons it is commonly six fingers breadth long, and four broad at the basis.

Coat. Outwardly it is covered with a proper Coat which is thin, but strong and dense, and very hard to separate from it; it is the same with the outer Coat of the great Artery, as that which cloaths the Ventricles on the inside is continued unto and common with that thin skin that covers the inside of the Arteries like a *Cuticula*: and hence 'tis likely (says *Diemerbroeck*) that the Arteries borrow these Coats of the Heart, as the Nerves borrow their two Tunicles from the *Pia* and *Dura mater* of the Brain. Upon this Membrane that invests the Heart, there grows some hard fat about the basis, which serves to moisten it.

Vessels. It is not nourished by the blood or chyle that are received into its Ventricles, but by Vessels running through its *Parenchyma*.

Its

Its *Arteries* are two, springing out of the *A. Arteries*. *orta* before it pass out of the *Pericardium*, and are called *Coronaria*, because their Trunks do not presently enter into the *Parenchyma* of the Heart, but fetching a circuit on its surface the better to branch out themselves towards its cone; they encompass its basis like a Diadem. And though at their rise they turn one on one side and t'other on the other of the Heart, yet at their ends they meet again and inosculate one with the other: so that if one inject any liquor into one, it will run into the other.

It has also two *Veins* called *Coronariae*; which *Veins* encompass its basis in like manner, and communicate one with the other. These receive and carry back the Arterial blood that remains from the nutrition of the Heart, and refund it into the *Cava* just at its entrance into the right Ventricle.

Its *Nerves* do arise chiefly from the *Plexus car- Nervos*. *diacus* of the *par vagum* or eighth pair; into which *plexus* many twigs do enter from the Intercoastal. But a little below this *plexus* after the recurrent Nerve has parted from the Trunk of the *par vagum*, the *par vagum* sends forth on each side a notable branch: which being carried towards the Heart, and creeping along its basis behind, meet one another; and in all their progress send forth twigs through the whole Surface of the Heart; especially on its backside: as those branches which proceed from the *plexus cardiacus*, are dispersed chiefly on its foreside; as Dr. Willis affirmeth.

*The cause
of the mo-
tion of the
Heart.*

Great controverſie hath been and ſtill is about the *motion* of the Heart, *whether* it depend on the influx of the animal ſpirits, or on the accenſion and dilatation of the blood in its Ventracles, or partly on one, partly on the other. Plauſible Arguments are produced on every ſide, but ſuch as rather tend to ſhew the ſhortneſs and insufficiency of the contrary Opinions to ſolve this *Phænomenon*, than pretend to demonſtrate any certain reaſon of it. That the immediate Inſtruments of its motion are its Fibres, none can doubt; but what ſets theſe Fibres on work is all the queſtion. That it cannot be the Animal Spirits conveyed by the Nerves (*only*) is apparent, *firſt*, becauſe the Heart moves in the *Embryo* before either Brain or Nerve are ſo perfectly formed, that the Animal Spirits can be elaborated out of the blood by the former, or tranſmitted to the Heart by the latter: yea ſeeing they are made of Arterial blood, that muſt be ſent to the Brain by the pulſation of the Heart before they can be generated. And *ſecondly*, becauſe the Heart of living *Fætus's* (as of young Puppies) and of Eels, being cut out of the Body and from all the Nerves by which any Animal Spirits ſhould flow into it, will continue beating as long as 'tis warm: yea when it has ceaſ'd beating, if one throw warm blood or but warm water upon it, it will recover ſome kind of pulſation again. Which may ſerve alſo to convict the ſecond Opinion of Errour; for if its motion depended only on the dilatation or rarefaction of the blood, it would ceaſe as ſoon as the blood flows no longer into its Ventracles.

And for a further confutation of the ſecond Opinion, which ſuppoſes the accenſion (and conſequent

sequent dilatation) of the blood as the cause of this pulsation , Dr. *Lower's* Experiment, or his Observation seem argumentative beyond contradiction. His *Experiment* is this : " He drew " out of the *Jugular vein* of a Dog about half of " his blood away, injecting by turns into the " *Criural vein* a like quantity of Beer mixt with " a little Wine ; and this he repeated alternately so often, till instead of Blood there " flow'd out of the Vein only a paler tincture " like water wherein Flesh had been wash'd, or " Claret diluted with very much water ; and yet " the Heart in the mean time remitted but a little of its former pulsation. . . . His *Observation*, which he had from a Physician worthy of credit, is this : " A Youth about sixteen years " old, continuing bleeding for two days together ; his Friends and those that waited on " him, gave him good store of Broth to keep " up and recruit his Spirits ; which he swallowing " down greedily, his bleeding was now and then " encreas'd thereby , so that at length having " poured forth almost the whole mass of his " blood, that which now run out was dilute and " pale, neither of the nature nor colour of blood, " but liker the Broth he had drunk so much of : " and this kind of flux continued a day or two, " (the Heart the mean-while retaining its pulsation) till at length being stopt, the Youth " was restored by degrees to entire health, and " grew to a robust and lusty Fellow.] This Experiment and Observation, I say, do make it apparent, the motion of the Heart depends not on the accension and dilatation of the blood, for then when in the first the Beer and Wine, in the second the Broth flow'd into its Ventracles instead of blood, its motion must either have been

more notably alter'd, or rather have quite ceas'd, these liquors being so far distant from the nature of blood, especially the Broth.

And lastly, that this motion is not caused partly by the influx of the Animal Spirits, and partly by the accension and rarefaction of the blood, may be evinced by the Arguments produced against each Opinion apart: and yet if a Reason could be given, this seems the most probable. Namely, that the blood distilling into the Ventracles of the Heart, is in them accended and rarefied, so that requiring a larger space, it bears against their Sides: whereby the Heart being molested, it calls in the Animal Spirits for help, which coming in in convenient plenty contract its muscular Fibres, and so by straitning its Ventracles drive forth the blood contained in them into the Arteries. But we had rather ingenuously confess our ignorance of the reason of so admirable an action, and profess with Dr. *Lower*, that it is too hard for Man to conceive of; and that it is the Prerogative of God only, who *searcheth the secrets of the Heart*, to know the reason of its motion also.

CHAP. VI.

Of the Pulse, and the circulation of the Blood.

The Pulse. **T**HE motion of the Heart is called in Greek *Πῦξις*, in Latin *Pulsus*, pulse or beating. And this is performed by *Diastole*, or Dilatation, in which it receives blood into its Ventracles; and *Systole*

Systole, or Contraction, by which it expels it out of them.

Contraction being the proper motion of a *Systole* Muscle, the *Systole* is the proper motion of the *and Dia-* Heart; and the *Diaſtole* is but a ceasing or reſti-*ſtole*, tution from that motion. For in the *Diaſtole* the Fibres of the Heart are relaxed, during which the blood diſtills down into its Ventracles out of the Auricles; whereby when they are filled and in ſome meaſure diſtended, the Fibres both ſtreight and oblique begin to contract themſelves, and compreſs or ſtraighten the Cavities of the Ventracles, not only by conſtringing their ſides, but alſo by drawing up the cone or tip of the Heart nearer its baſis, whereby their Cavity is ſhortned, ſo that the blood is expelled with force out of them into the Arteries; which motion is called the *Systole*. But why the Heart ſhould keep ſuch ſtated turns of *Systole* and *Diaſtole*, and continue them for (it may be) fourſcore years together, *that* (as we ſaid above) we cannot conceive the reaſon of, but admire the Wiſdom and Power of the Creatour, in beginning and continuing ſuch a motion.

At the ſame time as the Heart beats, there is *whether* a pulſation of all the Arteries to be felt in the *the pulſa-* extream parts of the Body. Whence may ariſe *tion of the* a diſpute, whether the Arteries be not alſo en- *Arteries* dued with a pulſifick faculty. I incline to the ne- *depend* gative, and think their pulſation is meerly paſ- *wholly on* ſive, and that as for other reaſons, ſo upon the *that of the* account of theſe two Experiments, *Heart,* viz. 1. That if an Artery be cut in ſunder, and a Pipe be put into each end of the divided Artery, whereby the blood may be conveyed out of one into the other, the pulſation will continue beyond the Pipe, as well as on that ſide next the Heart.

And, 2. That in transfusion of blood out of one Animal into another, though the blood be received into a Vein, yet that Vein will have a pulsation answering to that of the Artery in the other Animal whence the blood issueth. So that the pulsation of the Artery seems wholly owing to the repeated *impetus* of the blood poured into it out of the Heart in each *Systole*.

The circulation of the blood.

Now seeing by the continual reciprocation of the Pulse there is a constant expulsion of blood from the Heart into the Arteries, and as continual an influx of blood into it out of the *Cava*; and seeing the *Cava* from whence the supply is, is never drawn dry, nor on the other hand, the Arteries that receive the blood continually from the Heart, unduly swell'd with it; it necessarily follows, that this motion proceeds *circularly*, viz. that the blood is continually driven out of the Heart into the Arteries, out of these into the parts to be nourished; from whence it is reformed by the Capillary Veins, which conduct it back through the larger into the *Cava*, and so at length it returns to the Heart again. The invention of which Circulation is owing to our Countryman Dr. *Harvey*, and may be proved undeniably by these reasons.

1. The great quantity of blood that is driven out of the Heart into the Arteries at every Pulse. For though the Ancients who knew not this Circulation, imagin'd that only a drop or two was expelled by every *Systole*, which they were necessitated to suppose, to avoid the great distension that the Arteries must be liable to, if any considerable quantity issued into them; yet it is certain and demonstrable that there must needs an Ounce or more be driven into them each time. For (taking it for granted that there is

no other way for any liquor to pass from the Stomach to the Kidneys but through the Heart, along with the blood) seeing if some Men at some times drink three Pints of Drink, they shall Piss it out again in half an hour, yea more of *Tunbridge Waters* in that space; and seeing secondly, that there is commonly as much blood as *Serum* that flows to the Kidneys (the blood returning back by the Emulgent Veins) it is clear that by the two Emulgents (which are none of the largest Arteries) there must pass in half an hours time six pounds of liquor, all which must come from the Heart; and how much more then may we conceive to be driven through all the other Arteries that run through the whole Body? This is more accurately evinced by Dr. *Lower's* Experiment, which is this: " I cut asunder. (*says he*) both the *Cervical* Arteries in a large Dog, and at the same time through an hole made in the left side of his Breast over against the Heart, I compressed the Trunk of the *Aorta* below the Heart with my Finger, to hinder any blood from descending by it; and lastly, I took care also to straiten the *Brachial* Arteries under the *Axillæ*, by which means almost all the blood was driven out of the Heart through the *Cervicals* (besides that which was sent into the *Vertebrals*) and which is wonderful to be related, within the twentieth part of an hour the whole mass issued out; so that it is not to be denied but that it all past through the Heart in that space.] And though it may be granted that amidst such wounds and tortures the Heart does beat somewhat quicker than at other times; yet the same thing is partly evident from wounds in the Limbs when some notable Artery is cut asunder, for 'tis strange in

how small a time a Man will bleed to death even at that one Artery. Yea we may give a great guess how much blood is sent out at every Pulse, even from the ordinary opening of one *Vein* in the Arm, from whence a notable quantity of blood will issue in a short time; how much then may we suppose would flow out of all the Veins, if they were opened at one time? Seeing then 'tis evident that so great a quantity of blood is expelled out of the Heart at every *Systole*, and that for all that the Arteries are not unduly distended nor any part swell'd by it, neither yet the *Cava* and other *Veins* emptied, 'tis certain that the blood that is driven into the Arteries flows back to the Heart by the Veins, in a constant circulation.

2. A second Argument to prove it, may be taken from the Valves in the Veins, which are so framed that blood may freely flow through them out of the lesser Veins into the greater, (and so into the *Cava*) but not on the contrary out of the greater into the less. Yea if one blow into the *Cava* through a Pipe, there will no wind pass into the smaller Veins; but on the contrary, if you blow up the lesser Veins, the wind will readily pass to the larger, and so to the *Cava*.

3. And lastly, The same thing is most clear by the Ligature in Blood-letting. For whether you let blood in the Arm or Foot, you always tie the Fillet above where you intend to make the orifice, and then the Vein below the Ligature will presently fill and grow tumid, but above, it will fall and almost disappear. Which must needs be from thence, for that the blood being driven along the Arteries towards the extreme parts, returns by the Veins and ascends upwards; which coming to the Ligature and being stop't there, swells

swells the Vein below the Ligature, and spurts out as soon as the orifice is made: but when the Fillet is loosed again, the blood flows no longer out thereat, but holds on its wonted chanel, the Vein, and the orifice closes up again.

Having sufficiently demonstrated the Circulation of the Blood, we will shew two things further; *first*, how the blood passes out of the Arteries into the Veins, and *secondly*, in how long a time the whole mass of blood may be supposed to pass through the Heart in its ordinary Circulation.

As to the *first*, it was the Opinion of *Riolanus* How the blood passes out of the Arteries into the Veins. that the blood circulated only through the larger Vessels, by anastomosis or inosculation of the Veins with the Arteries; and that that which run into the smaller, was all spent on the nutrition of the parts. But it is clear that there must be a circulation even in the smallest, from the great quantity of blood that will flow out of the least Artery in the Hand or Foot, when it is cut; which it were very absurd to imagine to be all spent on the nourishment of the respective part. Now there are but two ways whereby the blood can be supposed to pass out of the Arteries into the Veins, *viz.* either by the former's being continued to or opening into the latter by inosculation, or else by the Capillary Arteries letting out their blood into the pores of the substance of the parts, on whose nutrition part is spent, and the remainder imbibed by the gaping mouths of the Capillary Veins. That it is necessary to admit of this *latter* way, is evident, because if part of the Arterial blood did not issue into the substance of the parts, they could not be nourished by it; for while it is in the Vessels, it may add warmth indeed to the parts thro' which it flows, but

but cannot nourish them, seeing even the Vessels themselves are not nourished by that stream of blood that glides along their Cavity, but by Capillaries running through their Coats; and if the blood be driven into the substance of the parts, and that in a greater quantity than suffices for their nourishment, (as was just now shewn that it is) what is superfluous must needs enter the mouths of the Capillary Veins, from which it goes forward to the larger, and so to the Heart: But seeing this way of transfusing the blood through the substance of the parts has seemed to some not to answer to that hasty circulation of it we above demonstrated; they have thought it necessary also to admit of the *former* way, namely anastomoses, by which the Veins are continued to the Arteries, and that not only in their larger branches (as that notable one of the Splenick Artery with the Splenick Vein) but also in their smaller twigs in the extreme parts. But we must consider, that in a living body the solid parts are infinitely more porous and permeable than in a dead; so that though the Anatomist find their substance so dense and close, as to make it seem almost impossible they should permit so quick a passage to the blood through them: yet he should rather believe it, than suppose such anastomoses as he cannot discover, (though it were not difficult to find them out if they had an existence.) For abating that single one of the Splenick Artery with the *Ramus Splenicus* of the *Porta*, (and perhaps some of the *Arteria* with the *Vena pulmonaris* in the Lungs) none of the latest most accurate Anatomists have been able to find out any. And as for that mentioned, it seems rather to be of an Artery with an Artery (such as are frequent in several parts of the body, as are also

also of one Vein with another) than of an Artery with a Vein ; for the *Porta* from which this *Ramus* is propagated, is generally reputed rather an Artery than a Vein, for the reasons alledged in Chap. 12. of Book I. where we described this Vessel.

And *secondly*, as to the space of time in which the whole mass of blood may ordinarily circulate through the Heart, it is probably much shorter than many have imagined. For supposing that the Heart makes two thousand pulses an hour, (which is the least number any speak of, and some have told twice as many) and that at every pulse there is expelled an Ounce of blood (which we may well suppose, seeing the Ventracles are wide enough to contain two Ounces, and that it is probable, both that they are filled near full in the *Diastole*, and that they are near if not quite emptied by the strong constriction of the Heart in the *Systole*) seeing the whole mass usually exceeds not four and twenty pound, it will be circulated six or seven times over through the Heart in the space of an hour. And by so much the oftner, by how much the blood comes short of the supposed quantity, or the pulse either naturally, or by a Fever, spirituous liquors, or violent motion is rendred more frequent. By which quick motion the blood it self is kept from coagulation and putrefaction, and the parts are cherished with vital heat, which heat of the parts is much according to the slowness or rapidness of the circulation : so when we sit still, and the pulse is slow or rare, we grow cold ; but when upon running or any violent exercise the pulse becomes more frequent and quick, we become hot.

In what space of time the whole mass circulates.

CHAP. VII.

How Blood is made of Chyle, of its Heat and Colour, and whether the Body be nourished by it.

According to Dr. Harvey's Observations, there appears in an *Embryo* a *punctum saliens*, or red beating speck, which is Blood, before any the least Lineament of the Heart. So that whatever Instrument of Sanguification the Heart may appear to be afterwards, it contributes nothing to the making of the first blood; but it seems rather to be made for the blood's sake, to transmit it to all the parts of the *Embryo* or *Fetus*, than the blood to be made by it. But it must be confessed that things proceed in the grown *Fetus* far otherwise than they do in the first formation. For the parts of an *Embryo* are nourished and encreased before it hath a Stomach to concoct any thing, and yet in a perfect *Fetus* none can deny that the Stomach does concoct and prepare nourishment for it: so it moves before the Brain is formed so perfectly as to be able to elaborate Animal Spirits; and yet after it is perfected, every one knows that the Brain does elaborate such Spirits, as being sent into all the parts of the Body by the Nerves, enable them to move. In like manner though there be blood in the *Embryo* before the Heart be formed, yet after it is perfected, nothing will hinder but it may at least contribute something to Sanguification.

We will suppose then, that as all the other parts are formed by the *Vis plastica* or generative faculty

faculty of the (first) vegetative and (then) animal Soul, seated in the *Ovum*, and receive their first encrease by the assimilation of the *colliquamentum*; but as soon as they are perfected, and the *Fætus* excluded, are nourished by the blood: so the blood it self being at first made in like manner, as soon as the Veins, Heart and Arteries are completed so as it can circulate by them, may, not improperly, be said to be nourished by the Chyle or nutritious juice, the Heart assisting the assimilation of the one into the other. And this is done in this manner. The Chyle ascending by the *Ductus thoracicus* (as was described, Book I. Chap. 10.) and flowing into the Subclavian Vein together with the returning venal blood, is poured by the *Vena cava* into the right Auricle, and so into the right ventricle of the Heart in its *Diastole* or Relaxation; then by its *Systole* or Contraction it is driven out from thence into the Lungs, from whence it ascends again into the left Auricle first, and then into the left Ventricle of the Heart, out of which it is expelled through the *Aorta*, and passing along with the blood through the Arteries of the whole body, returns again with it by the Veins to the Heart. For it undergoes many circulations before it can be assimilated to the blood. Which is evident, both because it is the Chyle (but little alter'd) that is separated in the *Placenta uteri* for the nourishment of the *Fætus*, and in the Breasts for the Infant to suck, in the form of Milk; and also from hence, that if one be let blood four or five hours (or later) after a full Meal, there will a great quantity of the milky Chyle it self swim a-top the coagulated blood. But every time the new infused Chyle passes through the Heart with the blood, the particles of the one are more intimately

How chyle is turned into blood.

ly

ly mixed with those of the other in its Ventricles, and the vital Spirit and other active principles of the blood work upon the Chyle; which being full of salt, sulphur and spirit, as soon as its *Compages* is loosened by its fermentation with the blood in the Ventricles of the Heart (especially, but also in the Arteries) the principles having obtained the liberty of motion do readily associate themselves; and are assimilated with such parts of the blood as are of a like and suitable nature; so that at length all the mass of Chyle that is capable of being turned into blood, is sanguified; and what is not, is evacuated by Urine or Stool, or other proper Emunctory.

*How the
blood be-
comes hot.*

It is a very difficult question, by what means the blood acquires its *heat*. In order to the resolution whereof it will be necessary to consider how many ways a *liquid body* is capable of being heated, and those (according to Dr. *Willis*) are three. “*First*, by setting it to something that is hot; so Water is made hot by being set on the Fire, or in the Sun, or a Stove, or by dissolving Lime in it. *Secondly*, when Saline Corrosives, which are of a contrary nature, being mixt with one another, or with sulphureous, act one on another, and by the great struggling and agitation of their particles do often excite heat, yea sometime smoke and burning: as when spirit and butter of Antimony, or when *aqua stygia* and Oyl of Turpentine are mixed together; also when corrosive liquors eat into metallick bodies, they often grow hot. *Thirdly*, (which is the only way besides that a liquid grows hot) when some humour abounding with sulphur or much spirit is set on fire by holding
“ a flame

" a flame to it, and so grows hot by deflagration,
" as Brandy, &c. There are other ways indeed
" of calefaction, as *fermentation*, *putrefaction*, and
" *attrition*, whereby *thicker* or *solid* bodies often
" grow hot, but in *liquid* they produce no such
" effect. Thus Leaven becomes (somewhat) hot
" by *fermentation*, and Dung or wet Hay by *pu-*
" *trefaction*; but neither way will a *liquid* body
" wax hot: for though Wine, Cider, &c. fer-
" ment so much as to burst the sides of the Hogs-
" head, yet they are not actually hot; nor will
" blood become so, when it is let out of the bo-
" dy, dispose it how you will in fit Glasses to fer-
" ment or putrefie. Indeed the blood within the
" body is fermented, and is thereby depurated,
" but it is not heated by such fermentation, as
" neither is any other liquid. Neither does the
" heating by *attrition* agree to it; for though so-
" lid bodies are heated by being rubb'd one a-
" gainst another; yet shake and agitate Liquids
" as much as you will, they shall be never the
" warmer for it. Therefore seeing there are
" only those three ways first mentioned whereby
" actual heat can be produced in any Liquors,
" let us see to which of them the incalescence of
" the blood ought to be ascribed.

" *First*, both the Ancients and some Moderns
" are of opinion, that the blood is heated the first
" way, *viz.* by the admotion of something that
" is hot. Thus the former have taught that the
" *innate heat*, and the latter that the *vital flame* is
" lodged in the Heart, and heats the blood as it
" passes through it: But both these Opinions fall
" to the ground, since it is clear that the Heart
" is a *mere muscle*, and contains no fit fuel for
" perpetuating a flame, or I know not what im-
" planted

“planted heat: For though it must be acknowledged that the circulation of the blood depends on the continual motion of this bowels, yet the *Heart* derives its heat wholly from the blood, and not the blood its from the *Heart*.

“*Secondly*, this heat cannot be caused in the blood the second way, because its liquor in a natural state is always homogeneous; and though it abound with salt, yet that is only volatile, mild and benign. Nor can any one discover either in the *Heart*, or in any other focus a saline or otherwise heterogeneous mineral, by acting whereupon or corroding whereof the sanguineous liquor should conceive heat.—

“*Thirdly*, as to the third way, whereby liquids grow hot, though it seem an hard saying, that the blood is accended; yet seeing we can attribute its incalcescence to no other cause, why should we not impute it to this? especially seeing the proper passions of fire and flame agree to the life of the blood.

“For the chief and most essential Requisites to continue a flame are these three, *first*; that a free and continual access of air be granted to it as soon as it is kindled; *secondly*, that it enjoy a constant sulphureous pabulum or fuel; and *thirdly*, that it be ventilated, whereby as well its fuliginous, as thicker recrements may be continually amended from it: And seeing these agree to the *vital flame* as well as to an elementary, it seems very rational to affirm that life it self is a kind of flame.] Thus far that learned Author, whom the Latin Reader will do well to consult discoursing further on this subject, in his *Exercit. medico-physica de sang. incalcescentia sive accensione*.

Dr. *Henshaw* thinks that " the dissimilitude of parts between the Chyle and Blood is so great, that it becomes immediately the cause of an extraordinary ebullition upon their mixture together ; which is very much encreased by the reciprocal motion of the Lungs, whereby the blood is wrought almost into a froth or foam by that time it gets into the left Ventricle of the Heart. Which sudden excess of heat, is not unlike what happens upon the mingling several Chymical liquors together, as spirit of *Wine* and spirit of *Turpentine*, and other such like, where the heat becomes so great, that it often endangers the Vessels they are contained in. He affirms (contrary to Dr. *Willis*, and I think to the truth) that " new Wine or Must while it ferments, is hot ; and that if juice newly pressed out of the Grapes were added to it as it begins to cool, it would again renew its ebullition, and its warmth would be continued so long as one should persist to do so : In like manner he thinks is the warmth in the blood continued by the new affusion of Chyle, which renews its fermentation, and consequently invigorates its heat.

Diemerbroeck is of opinion, that " the vital spirit (by which he understands the more subtil part of the blood) while through its great volatility it always endeavours to flee away, does continually agitate the other thicker particles of the blood, with which it is intangled and detained from flight, and is diversly vibrated by them, and beat back ; and so the whole mass being kept in a continual fermentative motion, there is produced in it an heat, which in a great agitation is great, in a mean, mean, and in a small, small.

I might cite other Opinions concerning the reason of this *beat*, but they generally fall in with some of these mentioned: of which I shall not make my self an Umpire, but think that Dr. *Willis* has said enough in his above-cited Exercitation, to evince that it is not caused either of these later ways; viz. by fermentation, or by agitation of the particles of the blood in the manner *Diemerbroeck* describes it; and whether the accension of the blood be a more probable reason of it, let the Reader judge.

The colour of the blood. Why the Blood should be of a *red colour* rather than any other, no satisfactory reason (I think) can be given, but the Will of the Creatour, though some attribute it to the Heart, others to the mixture of salt and subacid juices with sulphureous, because from such a mixture there results a red colour, as appears in the distillation of Sal nitre, (which contains many sulphureous particles in it;) or by the pouring Oil of Vitriol upon Conserve of Roses, or other thing that is of a *paleish red*, (if it contain any thing of sulphur) for it will be thereby made of a most *deep red*. We will not spend time to shew in how many respects these Instances differ from the *Phænomenon* under consideration, but shall content our selves with inquiring from whence the difference of colour arises between the Venal and Arterial Blood. Every one knows that when blood is let out of a Vein into a Porringer, the *coagulum* is of a florid scarlet colour in its surface, but of a dark red from the superficies to the bottom, and of such a colour it appears as it streams out of the orifice of the Vein. But if an Artery be cut, the stream then looks of a far brighter colour, like the superficies of the Venal blood when it is coagulated

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scarlet colour is owing meerly to the mixture of the particles of the Air with the Blood in the Lungs, from which it transpires, in a great measure, through the pores of the Skin, while the blood circulates in the habit of the Body out of the Arteries into the Veins, whence the Venous blood becomes so much darker in colour than the Arterial. And yet the Venous blood it self when extravasated appears of a scarlet dye in its surface, which is meerly from its being exposed to the Air; for if one turn the congealed blood in a Porringer upside down, the bottom which at the turning is blackish, will in a little while turn to a lighter red.

Whether
the Body be
nourish'd by
Blood.

Though we have confessed that the Chyle does circulate through the Body several times before it be perfectly assimilated to the blood; yet we do not think that it passes into the nourishment of the parts in the form of Chyle. And therefore when speaking of the Nutrition of the *Fœtus* in the Womb (Book I. Chap. 33.) we often mentioned a *nutritious juice* (which was Chyle a little alter'd) we did not call it so with respect to the solid parts of the *Fœtus*, but to the blood it self whose *Pabulum* or nourishment it is, as soon as the Umbilical Vein is formed, as the blood is of the Body. For as to the encrease of the first delineated parts of an imperfect *Embryo*, that is fat different from ordinary nutrition.

The Blood then consisting of particles of a different nature, each particle passes into the nourishment of that part which is of the same nature with it. So the salt and sulphureous particles being equally mixt, are agglutinated and assimilated to the fleshy or musculous parts; the oily and sulphureous to the Fat; the salt and tartare-

ous

ous to the Bones, &c. Now this is not done by any election or attraction of the parts, as if they pick'd and choos'd (with a kind of discretion) such particles of the blood as are suitable to their own nature; for the mass of blood is equally and indifferently carried to all the parts: But there is that diversity of figure both in the several particles of the blood and in the pores of each part, that in the circulation through the habit of the Body some stick in these, and others in those, where they are fasten'd and united to the substance of the respective parts; and those which through their peculiar figure are unapt to adhere to one or other, return again to the Veins and so to the Heart, where they receive some new alteration. So that as *the life of the Flesh is in the Blood* (according to *Levit. 17. 11.*) so has it its vital heat and nourishment from it also.

C H A P. VIII.

Of the parts of the Heart, viz. the Auriculæ, the Ventracles, and the Septum that divideth them.

HAVING treated of the *Heart* in general, and of its *Action*, &c. we now come to discourse of the *Parts* which it consists of, viz. its two *Auriculæ*, two *Ventracles* and the *Septum*.

The *Auriculæ* or *Ears* of the Heart are so called Auriculæ. from some similitude of shape they have with those of the Head: for they rise from a long basis, upon the basis of the Heart, and end in an obtuse point, making an obtuse triangle. They
X 3
are

are as it were two Appendages of the Heart, seated at its basis over the Ventricles. They are of the same fabrick and use, being both Muscles, and made up of the same order of Fibres, which are carried into opposite Tendons, whereof that at the basis of the Heart is common to it and these *Auriculæ*, and the other runs along their upper part. The right is larger and softer, the left is less, but more firm. Their superficies is smooth when they are filled; but when empty, it is wrinkled, and the left more than the right. When they are cut open, there appear in their Cavity many fleshy columns running from the upper to the lower Tendon, and betwixt them there are pretty deep Ditches or long Cavities, but fewer in the right than the left.

Their motion.

They are dilated and contracted in like manner as the Heart, but at different times: for the *Systole* of the Ventricles is at the same time with the *Diastrale* of the *Auriculæ*; and on the contrary, the *Systole* of the *Auriculæ* with the *Diastrale* of the Ventricles. So that the *Auriculæ* are a receiving their blood from the Veins, while the Ventricles are expelling theirs into the Arteries; and when the Ventricles are relaxed and empty in their *Diastrale*, the Auricles force their blood into them by their *Systole*.

Arteries.

They are not nourished by the blood that comes into and goes out of their Cavity, but they have a great many branches of Arteries running through them for this purpose, which spring from the *Arteria coronaria*, and are called by Dr. Ruysch (I think the first observer of them) *Arteriæ Auriculares*; and must also, no doubt, have branches of Veins from the *Cava* to attend them. These *Arteriæ Auriculares* you have represented in the next Table, viz. XI.

They

They serve to receive the Venal blood immediately out of the *Vena cava*, and *Pulmonaris*, and to measure it, as it were, into the Ventricle. Whither that they may expel it with the greater force, the internal Fibres or Columns of their Cavity arising from their root where they are joyned to the basis of the Heart, reach directly outward towards the *Vena cava*, and *Pulmonaris*, and in the *Systole* of the *Auricula* grasp the blood contained in their cavity like so many fingers, and squeeze it into the Ventricle whilst they are relaxed in their *Diastole*. Use.

The Heart hath two Cavities, called *Ventricles*, The Ventricles. whereinto it receives the blood from its two *Auricles*, and out of which it expels it into the *Arteria pulmonaris* and *Aorta*. They are not altogether like one another; for the right is wider, and in shape almost semicircular, nor reacheth it down to the *Mucro* or tip of the Heart; whereas the left is almost round, and reacheth down to the very tip. Now though the outside of the Heart be smooth, yet these Ventricle are very unequal, having their sides hollowed into divers Interstices or Furrows, and interwoven with carnosus Fibres reaching this way and that way. They are more numerous in Men's Hearts, than in those of any other Animal; though such as are big, as Horses and the like, have them larger. These Fibres or fleshy Columns serve to straiten or constringe the Ventricle, and the clefts or furrows betwixt them help their sides to close more exactly in their *Systole* than they could have done, had they been smooth. The Fibres are more and stronger, and the furrows deeper in the left Ventricle than in the right, yea they are also in that side of the *Septum* that

makes part of the left, though that side that looks to the right be well-nigh smooth. For there was need of greater and stronger constriction in the left than in the right; seeing the right expels the blood to no greater circuit than through the Lungs, but the left to the extremest parts of the Body.

Septum.

They are divided from one another by the *Septum*, which is a carnous and dense partition that stands like a Wall betwixt them. It is hollow towards the left Ventricle, and (as was just now said) has such like Fibres and Clefts, as the rest of the Cavity; but towards the right it is convex or bunching out, and has but very little inequality. Many have been of Opinion that it has some wider pores through which part of the blood does pass immediately out of the right into the left Ventricle; but he that searches for them diligently will find none, unless he first make them with his Probe. And indeed if there were any in grown persons, we may much more suppose them to be in *Fætus's* in the Womb, in whom are several passages that after the birth are obliterated. But if these were in the *Fætus*, then should Nature have made those two other passages in vain, namely the *Foramen ovale*, whereby the blood passes out of the *Cava* into the *Vena pulmonaris* as it is entring the left Ventricle; and the *Canalis arteriosus*, which carries the blood out of the *Arteria pulmonaris* into the *Aorta*. I say, if the blood could have passed out of one Ventricle into the other (without going through the Lungs) by any pores that perforate the *Septum*, these other passages had been superfluous. And therefore we may suppose, that as in grown persons they cannot be found by any Probe or Bristle, so they were not there even while the

Fætus

Fœtus was in the Womb, seeing there was no occasion for them.

As to the use of the Ventricles, it may be learned partly by what has been discoursed in the three former Chapters, and partly by what shall be said further in the following, wherein we are to describe the Vessels opening into and out of them. Whither also we transfer the treating of their *Values* that are placed at their orifices.

C H A P. IX.

Of the ascending Trunk of Vena Cava.

BEcause the Vessels contained in the *Thorax* either open into the Heart or run out of it, having finished the description of It, we shall discourse next of *them* as appendages to it. But waving the repetition of what we discoursed Book I. Chap. 10. of the *Ductus chyloferus thoracicus*, that runs up the *Thorax* by the Spine, and opens into the Subclavian vein, and referring the Reader thither for the description of that vessel; I shall here only meddle with the Sanguiferous vessels, that are four in number, viz. *Vena cava*, *Vena arteriosa* (or *Arteria pulmonaris*) *Arteria venosa* (or *Vena pulmonaris*) and the *Aorta* or *Arteria magna*; and in this Chapter of the first, viz. *Vena cava*.

In the former Book, Chap. 12, and 13. where *Vena cava* we discoursed of the Vessels contained in the *Abdomen*, we supposed (with the *Galenists*) that both the *Vena portæ* and *Cava* had their rise from the Liver, not dogmatically asserting it, but supposing it for methods sake. And in Chap. 13. describing

describing the branches of the *Cava* in the *Abdomen*, we found it presently dividing it self (after its rise out of the upper part of the Liver) into the *Ascending* and *Descending* Trunk; the description of the branches of the latter (in the lower Belly) we there finished; but traced the *Ascending* Trunk no further than its penetrating through the Midriff up into the *Thorax*, deferring the further prosecution of it till this place that we come to treat of the Vessels contained in the *Thorax*.

Venæ
phrenicæ.

As it ascends through the Midriff it sends forth a small sprig on each side, called *Venæ Phrenicæ*; these run through the Midriff, the *Mediastinum* and *Pericardium*. If at any time matter gathered in the cavity of the *Thorax* be afterwards discharged by Urine, (which many Physicians have affirmed) it is probable that it is absorbed by the mouths of these Veins gaping in the upper side of the Diaphragm, (upon which such matter must be supposed to fluctuate) whereby it is brought into the *Cava*, and so in the circulation is separated by the Kidneys out of the Emulgent Arteries, and descends by the Ureters to the Bladder.

Venæ co-
ronariæ.

From the Diaphragm it passes undivided to the right Auricle of the Heart, but before it enter it, having pierced the *Pericardium* it sends forth sometimes one, sometimes two twigs called *Venæ coronariæ*, which compassing the *basis* of the Heart bring back into the *Cava* the blood that is superfluous from its nutrition. As these open into the *Cava*, there is a *Valve* placed, which permits the blood to return by them into the *Cava*, but hinders any to pass out of the *Cava* into them.

Before this Trunk of *Vena cava* open into the Auricle, it is joyned to that other Trunk that descends

descends from the *Clavicula*, (though for method's sake we must consider *that* as a continuation of *this*, by and by) and both of them discharge the blood contained in them by one mouth first into the Auricle and then into the Ventricle of the Heart. As they are going to joyn, there comes a Tubercle or Protuberance betwixt them, that hinders the one from opening into the other in a direct line, but makes them both go obliquely towards the left hand as they enter the *Auricula*; without which provision, that blood that is a descending from the *Clavicula* would have fallen so full on that which is ascending by this Trunk of the *Cava*, we have been a describing, as must have made it either to stagnate (if not regurgitate) or however would have retarded its motion.

Now immediately beyond this Protuberance, out of the united Trunk there goeth a passage (called *Foramen ovale*) along the *basis* of the Heart to the *Vena pulmonaria* in *Fœtus's* in the Womb, which as soon as they are born closes up and is obliterated. The reason of this passage of the blood in them is, because their Lungs having either none or but a very obscure and imperfect motion, the blood does but little of it pass through them, but a good part of it through this *Foramen* out of the *Cava* into the *Vena pulmonaria* just as it is entring into the left Auricle, through which this blood is discharged into the left Ventricle together with that little that is returning by the said *Vena pulmonaria* from the nutrition of the Lungs. For though there be expelled out of the right Ventricle a pretty quantity of blood at every pulse into the *Arteria pulmonaris*, yet there is but a little of it that goes to the Lungs, (though all do in adult persons, that
it

it may be there impregnated with air) but the greatest part by a Pipe arising from this Artery, called *Canalis arteriosus* runs into the *Aorta*, which Pipe does degenerate into a Ligament after the *Fœtus* is born. So that the *Fœtus* in the Womb liveth after the manner of Fish or other Creatures that have no Lungs, and but one Ventricle of the Heart ; for there is but very little of its Blood that passeth any more than one of its Ventricles in one circulation, that which circulateth through one missing the other. But to return :

The united trunk of the *Cava* opens by one large orifice into the right ventricle of the Heart, (as most Anatomists have taught ; but *Steno* affirms , it goes no further than the Auricle) into which is poured all the Blood that returns from all the parts of the Body (except the Lungs) in its circulation. And lest in the *Systole* or constriction of the Heart, the Blood should be expelled the same way it comes in ; at the orifice of the *Cava* there grows a membranous circle, which is cleft into three membranous *Valves*, looking inwards, called *Tricuspidæ* (or three-pointed) which permit the Blood to come in, but not to go out. And this office these Valves perform in this manner , (as is most ingeniously described by Dr. *Lower* .) Out of the sides of the right *Ventricle* there grow certain *Papillæ*, or round and long Caruncles (called before , fleshy Columns) from whose top there proceed certain tendinous Fibres that are knit to these Membranous *Valves*. Now these Membranes encompass the orifice of the *Cava* round about, so that whereas the *Mucro* or tip of the Heart is in every *Systole* drawn up towards the *basis*, the *Papillæ* being also moved upwards, do slacken their Fibres (like Bridle-reins) whereby it comes to pass that the Membranes (or

Valves)

*Valvula
tricuspidæ.*

Valves) also, to which they are tied, hanging loose are driven upwards (like sails filled with wind) by the Blood that is squeezed in every *Systole* of the Heart, and thereby they shut this inlet into the Heart so closely, that not a drop of liquor can flow back again into the *Auricula* or *Cava*, but is expelled all into the *Arteria pulmonaris*, whose orifice is now open: But, as in every *Systole* of the Heart (its tip being brought nearer its *basis*) the *Papillæ* do much relax their *Fibres*; so in the *Diastole* the tip receding from the *basis* again, does also draw down the *Papillæ*, and their *Fibres* with it: whence it comes to pass that the *Membranes* or *Valves* being also drawn down, do presently uncloſe this orifice, and open the door as it were for more Blood to come in, what came in before being expelled in the last *Systole*.

The two Trunks of the *Cava* having thus discharged themselves by one orifice into the right ventricle, that Trunk which ascends towards the *Clavicula* (for so we must consider it for orders sake, though in truth it descends from thence) as soon as it is gone out of the *Pericardium*, sendeth forth a notable branch called *Vena sine pari*, (or *Ævy*) because it is but one, having no fellow.

It ariseth out of the hinder part of the *Cava*, *Vena sine* but more towards the right hand, and descends *pari*. through the right side of the cavity of the *Thorax*. After its rise, which is betwixt the fourth and fifth *vertebra* of the Breast, it bends a little forward toward the right hand, till it be descended as far as the eighth or ninth *vertebra*, where it begins just to keep the middle. It sends forth on each side *Intercoſtal* branches to the *Interstices* of the eight lowest *Ribs*; and at the eighth *Rib* it is divided into two branches: One whereof, being the larger, descends toward the left hand betwixt the

the processes of the Diaphragm, and is inserted sometimes into the *Cava* above or below the Emulgent, but oftener into the Emulgent it self: The other being the *right* is joined also to the *Cava*, commonly a little above the Emulgent, but seldom into the Emulgent it self.

*How Pus
collected in
the Thorax
is voided
by urine.*

It was formerly held, before the circulation of the Blood was found out, that in an *Empyema* of the *Thorax*, the matter was absorbed by the mouths of this Vein, and carried directly to the Emulgent Veins, where it was separated with the *Serum* by the Kidneys. But seeing the Blood does indeed ascend from the Emulgents by this Vein, and that at its insertion into them there is commonly a Valve that hinders any thing from issuing out of the *Vena sine pari* into the Emulgent, but permits the contrary; it is certain, that if this Vein be at any time an instrument to evacuate such *Pus*, it must first ascend to the *Cava*, and pass through the Heart, and so be carried to the Kidneys by the *Aorta* and the Emulgent Arteries arising out of it. But though it is difficult to conceive how the mouths of this Vein should open so wide into the cavity of the *Thorax*, as to imbibe slimy ropy *Pus*, and yet not let forth the Blood that is more fluid; so that one would hardly assign this office to it: yet when the *Pus* is collected betwixt the *Pleura* and Intercoastal Muscles, and the Tumour does not burst, I see not why it may not be supposed that the Intercoastal branches of the *Vena sine pari* do imbibe the matter out of the Tumour, and carry it that way which was just now spoken of. And if ever *Pus* be imbibed out of the cavity of the *Thorax*, because it floats upon the Diaphragm, the *Venæ phrenicæ* are liker to do it than this, as was noted before in this Chapter, when we described those Veins. But the truth

is,

is, 'tis more probable, when such matter is voided by urine, that it is absorbed by neither of these vessels nor from the places mentioned, but rather by the *Vena pulmonaria* out of the Lungs when they apostemate.

Of this *Vena sine pari* we shall say no more, but that at its rise out of the *Cava* it has a *Valve* that opens towards the *Cava*, which having sent forth this vein, ascends on towards the *Clavicle*, strengthened and sustained by the *Mediastinum* and *Thymus*, and before it is divided into the two *Rami subclavii* (sometime after) sends out yet two other small veins called

The *superiour Intercostals*, on each side one, each of which has a *Valve* where it joins to the *Cava*, permitting the influx of the Blood into the *Cava*, but hindring its relapse. These run along the *Interstices* or *Intervals* of the three or four uppermost *Ribs*. Yet sometimes the *Vena sine pari* sends twigs to these four *Interstices* of the *Ribs* as well as to the eight lower, and then these *superiour Intercostals* are wanting. Interco-
stales su-
periores.

Afterwards the trunk of the *Cava* is divided into two large Veins, one of which goes to the right hand, the other to the left. These while they are within the Breast, are called *Venæ subclaviæ*, running along the under side of the *Clavicle*: but as soon as they are gone out of it, *Axillares*. They send forth several branches both upwards and downwards. Sometimes the *superiour Intercostals* just now mentioned (though seldom) arise out of them. Next, the Venæ sub-
claviæ.

Mammariæ descend from them, (though these sometimes spring out of the trunk of the *Cava*; so uncertain is the origine of some of these Veins.) These send forth double branches, Internal and External. The *Internal* run to the Branches
arising
from them.
1. Mam-
maria.
of

of the Ribs and their Intercoſtal ſpaces, and ſome of their twigs alſo are terminated in the glands of the *Mammae*. The *External* paſs down on the outside of the *Breſt*, and ſend many twigs into the ſaid glands, and marching further by the ſides of the *Cartilago enſiformis* deſcend out of the *Thorax*, continuing their courſe down the *Abdomen*, under the ſtreight Muſcles thereof, till about the Navel, where it hath been an old Tradition that they inoſculate with the *Venæ epigaſtricæ*; but this was a miſtake, as has been noted more than once already. *Bartholin* ſays that ſometimes there is but one *Mammaria*.

2. *Mediaſtina*.

The ſecond Vein that ariſeth out of the Subclavian is the *Mediaſtina*; this ſends twigs to the *Mediaſtinum* (from which it hath its name) to the *Pericardium* and to the Gland called *Thymus*. This alſo ſometimes ſpringeth out of the trunk of the *Cava*.

3. *Cervicalis*.

The third is *Cervicalis* or *Vertebralis*; this turns backwards towards the *vertebræ* of the Neck, into whoſe lateral holes it enters by ſome ſmall twigs, which diſperſe themſelves through the Membrane that inveſts the marrow contained in theſe *vertebræ*; and other twigs it beſtows upon the Muſcles that lie next upon the *vertebræ*.

4. *Muſcula inferior*.

The fourth is *Muſcula inferior*; this is ſpent upon the lower Muſcles of the Neck and the upper of the *Thorax*. It riſeth ſometimes from the external Jugular.

All theſe ſpring from the lower ſide of the Subclavian veins; but theſe that follow from the upper. As

5. *Muſcula ſuperior*.

The *Muſcula ſuperior*, which is diſperſed thro' the Muſcles of the Neck.

6. *Jugulares*.

Then the *Jugulars*, which are double, *External* and *Internal*. As theſe go out of the Subclavian

vians, there is placed sometimes one thin Valve, sometimes two, to hinder the return of the Blood out of the Subclavians into them.

The *External* ascend on the outside of the Neck, and these are they which are opened when one is let blood in the Neck for any Distemper of the Head, or Quinzy, &c. They ascend but just under the Skin, and provide for the outward parts of the Neck, Chaps, Head and Face. They make the Temple-veins, and the Forehead-vein, both which are wont sometimes to be opened. Yea they send small Capillaries through the sutures of the Skull into the Membranes that cover the Brain.

The *Internal*, in Men, are larger than the *External*. They ascend from the Subclavian by the sides of the Wind-pipe, on which they bestow small twigs. As soon as they are come to the bases of the Skull, they are each divided into two, the greater and less. The greater is carried backwards, and by that hole of the *Os occipitis* by which the sixth pair of Nerves (Dr. Willis's eighth) comes out of the Head, they enter in, and are dispersed through the *Dura Mater*, &c. The less enters in by the holes made for the third and fourth pair of Nerves, and is also bestowed on the *Dura Mater*, &c.

When the Subclavian Veins have sent forth all these branches, they then pass out of the *Thorax*, and begin to be called *Axillar*, of which we shall treat in the Fourth Book, Chap. i.

Into the *Vena subclavia* are inserted also the *Ductus chyloferus thoracicus* (of which in the First Book, Chap. 10.) and *Lymphaticus ramus*, which returns the *Lympha* from the Arms, Neck, &c. but sometimes this opens into the Jugular.

C H A P. X.

Of Vena arteriosa, and Arteria venosa.

Vena arteriosa.

THE second vessel in the Breast is commonly called *Vena arteriosa*, but more properly *Arteria pulmonaris*; both because it performeth the office of an Artery, in carrying Blood out of the right Ventricle of the Heart to the Lungs; and also because its Coat is double like that of other Arteries.

Its Valves.

As it riseth out of the right Ventricle of the Heart, there stand at its orifice three Membranous *Valves* looking outwards, called *Semilunares*, because they make as it were a half circle, as also *Sigmoides* or *Sigmoideæ*, from the shape of the Greek letter *Sigma*, which of old was of the same figure with an English *C*. These Valves are made of the tendons of the Fibres of the Heart, as *Steno* affirms; yea the same tendons, he says, pass into the substance of the Artery it self. In the *Systole* of the Heart they open, and permit the Blood to issue out of the Ventricle into this Artery; but in the *Diastole* they shut, so that none can return back again. A little beyond these valves in a *Fœtus* in the womb there springs out of this Artery a pipe called *canalis Arteriosus*, that runs across the Breast to the *Aorta*, into which it conveys the greatest part of the blood out of this Artery, without its passing through the left Lobe of the Lungs, or the left Ventricle of the Heart; but as soon as the Child is born it closes up, and turns ligamentous, as was said before of the *foramen ovale*.

Branchings
in the
Lungs.

As soon as it is past out of the *Pericardium*, it bends towards the *Aspera Arteria* or Wind-pipe, and

and is divided into the right and left branch, which applying themselves to the like branches of the *Aspera Arteria* do every where accompany them on the under side, and as they run along send out very many twigs on every side, which presently associate with those of the Wind-pipe, and of the *Vena pulmonaris*. And where the small Pipes of the *Aspera Arteria* end into the little round Cells (which we shall describe in the Chapter of the Lungs) the twigs of this Artery being interwoven with those of the Vein do embrace them like a Net. Whence one may guess that the reason why the sanguiferous vessels do so exactly accompany all the branches of the Wind-pipe and its annexed little Bladders, is, that the whole mass of Blood passing this way may be inspired or impregnated with the particles of the nitrous Air. For there is but a very little spent on the nutrition of the Lungs, but the greatest part of it is received by the small twigs of the *Vena pulmonaria* which accompany those of this Artery in all its ramifications.

The third vessel is called *Arteria venosa*, otherwise *Vena pulmonaria*; this has but a single Coat as the other Veins have. After it has accompanied the Wind-pipe and *Arteria pulmonaris* in all their branchings in the Lungs, and by its small twigs has received the Blood (by *anastomoses* as most affirm) out of the Artery, all these twigs are united first into two trunks (*viz.* the right and left) afterwards into one, which opens into the left Ventricle of the Heart.

At its orifice there are placed two membranous *Valves* called *Mitrales*, because when they are joined together they do in some manner resemble a Bishop's Mitre. They are of a stronger texture

ture than those called *Tricuspidæ* at the orifice of the *Cava* in the right Ventricle; and so are the Fibres, that ascend to them from the *Papillæ* or fleshy columns, stronger. For seeing the Blood is expelled more impetuously out of the left Ventricle than out of the right, (for the Blood sent out of the one is to circulate only through the Lungs, but that out of the other, through the whole Body) it was convenient that the valves and Fibres should be stronger, to sustain the violent motion of the Blood, and hindring it from returning into this *Vein* again, to direct its course into the *Aorta* whose orifice opens in the *Systole* of the *Ventricle*.

Just as this *Vena pulmonariæ* is entering into the left Auricle, there is, in a *Foram* in the Womb, a Pipe called *Foramen ovale* that opens into it coming from the *Cava*, as was noted above; To which we shall here add, that at its orifice into this *vein* there is a valve placed, that hinders any Blood from returning into the *Foramen* out of the *vein*.

And here there is one thing worth noting concerning the pulmonary *Artery* and *Vein*: That whereas in all the other *Arteries* and *Veins* through the whole Body besides, the Blood contained in the *Arteries* is of a bright scarlet colour, and that in the *Veins* of a black purple; on the contrary, the *Arteria pulmonatis* containeth black purple Blood, and the *Vein* scarlet-coloured. The reason whereof was shewn before, Chap. 7. viz. That the scarlet colour of the Blood is wholly owing to the mixture of Air with it in the Lungs. And therefore that Blood which the pulmonary *Artery* brings into the Lungs out of the right ventricle of the Heart, being the Venal blood that was brought thither from the circulation by the

the *Cava*, changes not its colour till it passes out of the small twigs of the said Artery into those of the pulmonary *Vein*, where the airy Particles insinuate themselves into it, and so alter its colour.

The pulmonary *Vein* hath no Valve in it, except that at its opening into the left Ventricle. Of which Dr. *Willis* gives this reason, That the Blood within the *Pracordia* may always, because of the *Impetus* of the passions, freely fluctuate and regurgitate both ways, backwards and forwards. And lest the left ventricle of the Heart should at any time be suffocated by the Blood rushing too impetuously into it, the fleshy Fibres in the root of the Vein (for both this and the *Cava* have such there, which seem to make a kind of Sphincter) by the instinct of Nature contracting themselves invert its course, and make it flow backward toward the Lungs.

C H A P. XI.*Of the Aorta, or great Artery.*

THE fourth vessel is the great Artery called *Aorta*. *Aorta* (*arcula*, a little Chest) and by way of eminency *Arteria magna*, because it is the greatest Artery of the whole Body, from which all the others (except the pulmonary) are derived.

It springeth out of the left ventricle of the Heart, and at its rise hath three *Valves* looking outwards, called *Semilunares*, being altogether like those at the orifice of the *Arteria pulmonaris* in the right ventricle. And these with the *Aorta*,
Y 3 according

according to *Steno*, are both of them constituted of the tendons of the Fibres of the Heart, as well as the *Sigmoidea* and *Arteria pulmonaris*, of which in the former Chapter. These hinder the Blood from returning out of the great Artery into the Heart again. The orifice of the *Aorta* (or rather the Tendon of the Heart that is continuous to it) in some Creatures (especially in Harts) does often grow bony; and sometimes in Men, according to the observations of *Bartholin* and *Riolanus*.

Alſoon as the *Aorta* is gone out of the Heart, it aſcends not in a direct courſe towards the Head; for if it had, ſeeing it openeth ſtreight upward out of the ventricle, it would have poured the Blood (eſpecially in lying along) in too rapid a ſtream into the Brain, and the lower parts of the Body would have been defrauded of their due ſhare: but it firſt bends arch-wiſe, ſo that its bowed corner ſuſtains the firſt *Impetus* of the expelled Blood, and directs the greateſt torrent towards its deſcending trunk, and a leſſer quantity paſſes up by the aſcending, being to convey the Arterial Blood to fewer and ſmaller parts.

In a *Fœtus* in the Womb there comes a Pipe out of the *Arteria pulmonaris* into the *Aorta*, called *Canalis arterioſus*, which brings out of it the greateſt part of the Blood that was expelled out of the right *Ventricle*; little more paſſing into the Lungs than may ſerve for their nourishment; of which we have given the reaſon in the two former Chapters, as alſo in Book I. Chap. 34. After the *Fœtus* is born, the *Canalis* degenerates into an impervious Ligament, as was alſo noted before.

Before the *Aorta* come out of the *Pericardium*, it ſendeth forth ſometimes one, but oftener two ſmall Arteries, from each ſide one, which compaſs the *basis* of the Heart like a Garland, in their circuit

cuit sending down divers twigs length-ways of the Heart: they are called *Coronariae*. When these two small Arteries have incompass'd the *basis* and meet, they inosculate with one another, but not with the *Veins*. At their rise out of the *Aorta* there is a *Valve* placed that permits the Blood to flow out of the great Artery into them, but hinders its reflux.

These (as was above observed from Dr. *Ruyfch*) send branches to the auricles of the heart, and also to the whole substance of the heart it self; yea, according to the same Author, to the coats of the root of the trunk of the *Aorta* it self also.

When it hath pierced the *Pericardium*, and bended a little arch-wise backwards, it is divided into two Trunks, whereof the one is called *Truncus ascendens*, the ascending Trunk; the other *descendens*, the descending.

The division of the Aorta into the ascending and descending Trunk.

Of these two, the *descending* is largest, because it minisreth to more parts.

The but just now quoted Dr. *Ruyfch* does not approve of this division, but says, "that the trunk of the *Aorta* coming forth of the left *sinus* of the heart, tends upwards indeed, but making an arch is presently bended downwards; and as it so bends, it sends forth some branches to the parts situated above the heart, and especially the subclavian and *carotides*, and (which is to be noted) on the right side for the most part, if not alwayes, the *carotis* and subclavian artery are for a little space at their rise joined into one, otherwise than in the left side, where for the most part they come separately out of the *Aorta*. So that the *Aorta* is not divided by Nature properly into two Trunks, for both the ascending and descending trunk is the same. But if any be minded to call this *Aorta* as it ascends,

"scends, the ascending, and as it descends, the
 "descending, I will not be against it; but I have
 "by no means found it in man so separated and
 "divided into two parts, that the one part should
 "ascend, and the other descend, as it is repre-
 "sented in the figures of divers Authors.]

Thus he, and because he is a person very curious, I have here inserted his figures lately published in his Answer to *Gaubius's* third Letter.

Tab. XI.

Fig. 1. A The root of the trunk of the Aorta,
 out of each side of which spring

The coronary Arteries BB.

CC The Arteries running through the auricles of the heart.

D The little branches of Arteries springing out of the arteria coronaria, and dispersed through the coats of the root of the Aorta.

EEE Very numerous sprigs of Arteries spread through the substance of the heart.

FF The trunks of the coronary Arteries cut off, designed for the back side of the heart.

Fig. 2. A. The heart of a boy about ten years old.

BB. The Arteries dispersed through the substance of the heart.

C The right auricle of the heart.

D The trunk of the Aorta emerging and rising up out of the left sinus of the heart.

E The descending trunk of the Aorta.

F The right subclavian Artery united for a little space to the right Carotid.

G The left subclavian Artery coupled to the cervical Artery, and is less in diameter than the foregoing.

HH Each

Fig. 1.

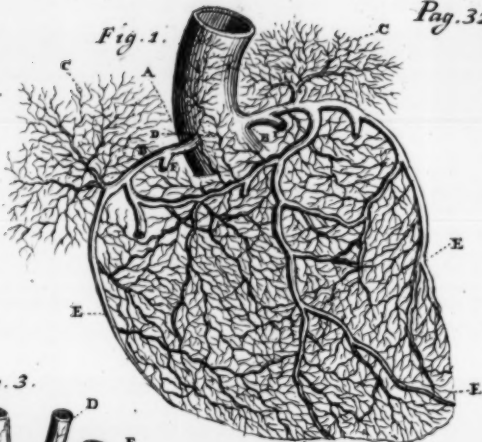


Fig. 3.

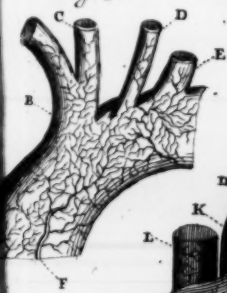
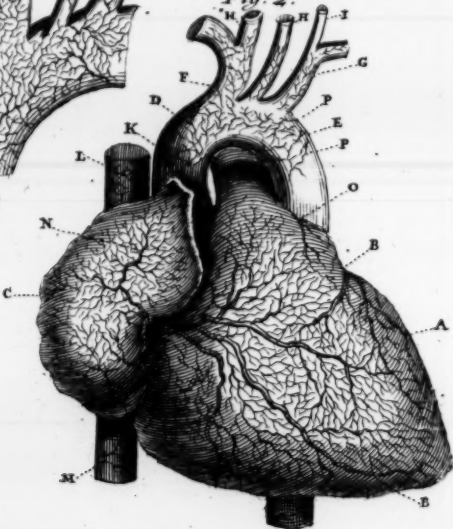


Fig. 2.



Ch

HH

K

L

M

N

O

PP

Fig

B

D

E

F

G

H

I

J

K

L

M

N

O

HH Each Carotid Artery.

The left cervical Artery.

K The little Arteries springing from the coronary Artery furnishing the coats of the root of the Aorta.

L The ascending trunk of the Vena cava.

M The descending trunk of the Vena cava.

N The Arteries distributed through the right auricle of the heart, and arising out of the coronary Artery.

O The root of the pulmonary Artery coming forth of the right Thalamus of the heart.

PP The little Arteries springing from the internal mammary Arteries, and distributed through the coats of the Aorta.

Fig. 3. A The trunk of the Aorta of an adult man.

B A branch of the right subclavian Artery, out of which the right carotid Artery springeth, noted by the Letter C.

D The carotid Artery of the left side.

E The left subclavian Artery.

F The branches of Arteries that spring from the Arteria coronaria.

Now though I must needs acknowledge that what this curious Anatomist speaks against the dividing the *Aorta* into its ascending and descending trunk has much reason in it, as appears by the second figure; yet having his lieve I shall adhere to the usual division, and proceed to observe the *ascending*, and *descending* trunks of the *Aorta* in their several off-springs, as they have been hitherto described.

The *ascending* Trunk then running up under the *Vena cava* lies upon the Wind-pipe, and presently sendeth forth two large branches, whereof the *ascending* Trunk a-
 The branches of the Trunk a-
 scending.

Arm:

1. *Subclavia*. Arm: They are called *Rami subclavii*, because they march under the *Claviculae*; and as soon as they are gone out of the Breast, are called *Axillares*. The right is the larger, and rising higher goes a more direct way towards the right Arm; the left is less, and rising lower ascends more obliquely towards the left Arm. They send out several branches both from their *lower* and *upper* side.

2. *Intercostalis superior*. From the *lower* proceeds the *superiour Intercostal*, which runs along the interstices or intervals of the four uppermost Ribs, and sends slips to the neighbouring Muscles and Spinal Marrow. These sometimes are propagated from the cervical Arteries, coming out through the holes of the *Vertebrae*.

3. *Mammaria*. From the *upper* side of each subclavian springs first *Mammaria*, which descends towards the Breasts through the Muscles that fill up the interstices of the cartilages of the true Ribs; and a considerable branch of each descending out of the *Thorax* by the sides of the *Cartilago ensiformis*, runs down the *Abdomen* under the *Musculi Recti*, spreading there into many twigs: which are said to inosculate with the extremities of the twigs of the epigastrick Artery ascending. But that opinion is so opposite to the circulation of the Blood, that it is impossible to be true. For the Blood can ascend by the *Mammaria*, nor descend by these ascending twigs of the *Epigastrica*.

4. *Cervicalis*. The next is *Cervicalis* (otherwise called *Vertebralis*) which sendeth slips to the *Vertebrae* and Muscles of the Neck, at whose seventh *Vertebra* it enters in by the holes of the transverse processes, and pierceth the Membrane that invests the Spinal Marrow, bestowing twigs both on the Membrane and Marrow, and runs up thereunto in at the great hole of the *Occiput*, and being

pass'd the Skull, both branches (the right and left) join under the *medulla oblongata*, and then are divided into innumerable most small twigs, which make wonderful net-like *Plexus* in the *Pia Mater* about the *Cerebellum*, and run into the substance of the *Cerebellum* it self; and some of them being united with those of the *Carotides* make part of the very *Rete mirabile*.

The third Artery that rises out of the upper side of the subclavian is *Muscula*, which is spent on la. *Musculi* of the Neck, and sometimes also on some of the Arm.

After the *Subclavians* have had all these pairs of Arteries going out of them, they pass out of the *Thorax*, and begin to be called *Axillar*, of which in Book IV. Chap. 2.

At the same place, or very near, where the ascending Trunk of the *Aorta* sends out the *Subclavians* side-ways, the remainder of it is divided into two, called *Carotides*, which ascend directly upwards, (though the right sometimes arises from the right *Subclavian*.) These at their rise are sustained by the *Thymus*, and having bestowed twigs on the *Larynx*, Tongue, the Muscles of the *Hyoides* and the neighbouring Glands, pass up on each side by the sides of the Wind-pipe to the Jaws with the internal Jugular Vein, and there are each subdivided into the *external* and *internal* branches.

The *external* is smaller, and is dispersed into all the Muscles of the Cheeks, Fore-head, Temples, Lips; and in general, through all the outer parts of the Head and Face.

The *internal*, which is larger, sends first some more twigs to the *Larynx*, Tongue, &c. as also to the Glands behind the Ears, and the spongy parts of the Palate and Nose. Then it entreteth the

the upper Jaw, and bestows a small slip on the root of each Tooth (as the *external* did on the roots of the Teeth of the lower Jaw) whereby sharp humours flowing in upon them sometimes cause a very painful Tooth-ach. The remainder of it climbs upon the Skull, being about its *basis* divided into two branches. The *left* and hinder whereof having sent one slip to the inner Muscles of the Neck, and another through the hole of the uppermost *Vertebra* into the Membrane that invests the spinal Marrow, ascending further enters the Skull at the hole by which the sixth pair of Nerves (commonly so called) comes out, and creeping along the *Dura Mater* ends near its *Sinus*, (which yet some say it enters.) The larger branch, tending upwards, is carried through the bony channel in the wedge-like bone with a winding duct to the *Sella equina* ; at whose *basis* after it has sent out a twig on each side into the *Dura Mater*, it opens it self into many small slips, which being interwoven with those of the cervical Artery (above-mentioned) make the *Rete mirabile*, which is more observable in Beasts than in Men. Yet it is not all spent on the said slips, but perforating the *Dura Mater*, it enters the *Pia Mater* with two notable branches, which being divided into very small twigs are mingled with those of the cervical Artery, with which they pass out of the Skull and accompany the spinal Marrow even to the Loins. Afterwards it sends a small branch through the second hole of the wedge-like Bone with the optick Nerve, out of the Skull, to the Eye. And yet still supplying more twigs to the substance of the Brain and *Pia Mater*, and being united with some other twigs of the cervical Artery, it makes the *Plexus choroides*.

The descending trunk of the Aorta, which is larger than the ascending, goes down by the Gullet, which it cleaveth. And hence is a Man that is hot, so much cooled with a draught of cold drink; for the Gullet being cooled thereby, the blood in the Aorta contiguous to it must needs be cooled likewise.

The branches of the Trunk descending.

Before it arrive at the Diaphragm it sends out of its hinder side the inferior Intercostals, which run along the interstices of eight or nine of the lower Ribs, namely those which the superior Intercostals did not supply. They likewise send off by the holes of the Vertebrae, made for the nerves, to the Marrow of the Back, and to the Muscles which rest upon the Vertebrae, and also to those of the Thorax. Sometimes above this and sometimes below it, there arises also out of the hinder part of the Aorta, an Artery called Bronchialis, first found out and so named by Frederick Ruysch, which accompanies all the Bronchia of the Wind-pipe.

1. Intercostalis inferior.

When it comes to the Midriff, there spring out of it the Phrenicæ, one on each side: these running all through the Diaphragm, pass up into the Mediastinum, and sometimes into the Pericardium.

2. Phrenicæ.

Then having penetrated the Midriff it descends in one trunk to the fifth vertebra of the Loins; at which passage it first sendeth forth Celiacæ, which ariseth single, and is so called, because it sendeth twigs to the Stomach. This springeth from the fore-part of the Trunk, at the first vertebra of the Loins, and descending under the hollow of the Liver, upon the Trunk of the Vena porta it is divided into two branches, the right and left.

3. Celiacæ.

The

Its branches.

Gastrica
dextra.
Cysticæ
gemellæ,

Epiplois
dextra.

Intestinalis.

Gastroëpi-
plois
dextra.

Hepaticæ.

Splenica.

Gastrica
major.

Corona-
ria stom-
achica.

Gastrica
sinistra.

Epiplois
offica.

The right which is smaller, ascending, produces in its upper part the *Gastrica dextra*, that comes to the *Pylorus*, whence *Spigelius* calls it *Pylorica*. And besides, the *Cysticæ gemellæ*, which are very small, and are dispersed through the Gall-bladder. And out of its lower side there spring

1. *Epiplois dextra*, which runs thro' the right side of the inner or hinder leaf of the *Caul* and the *Colon* that it is annexed to.

2. *Intestinalis*, bestowed on the *Duodenum* and beginning of *Jejunum*.

3. *Gastroëpiplois dextra*, on the right side (to the middle) of the bottom of the *Stomach*, and also on the *Caul* that is knit to its bottom.

4. *Hepaticæ*, which are two small ones: they are spent on the investing *Membrane* of the *Liver* (for its *Parenchyma* is nourished by the *Porta* the *Capsula communis*, the *Gall-bladder* and *Porta biliaris*).

The remainder of this right branch enters the *Mesentery* with many twigs.

The left branch of the *Cœliaca*, which is called *Splenicus* (sometimes springing immediately from the *Aorta*) is larger than the right, and as it goes towards the *Spleen* it sendeth forth of its upper side *Gastrica major*, which after it hath bestowed a slip on the upper and middle part of the *Stomach*, is divided into two others; the first whereof is called *Coronaria stomachica*, which encompasses the upper orifice of the *Stomach* like a *Garland*, and sends many twigs to the body of the *Ventricle* it self; the other *Gastrica sinistra* which (according to *Diemerbroeck*) is carried towards the right hand into the upper part of the *Stomach* and to the *Pylorus*. Out of its lower side spring, first *Epiplois postica*, which runs to the hinder leaf of the *Omentum*, and the *Colon* and

nexted to it; secondly *Epiplois sinistra*, which is bestowed on the lower and left side of the *Omentum*. Epiplois sinistra.

Just as this Splenick branch is entering into the Spleen, there arise out of its upper part *Vas breve arteriosum*, which goeth streight to the left part of the bottom of the Stomach; and the *Gastroepiplois sinistra*, which being sustained by the upper or fore-leaf of the *Omentum* sends some twigs thereto, and also to the left part of the bottom of the Stomach, and to both its fore and hinder sides. Then it enters into the Spleen, whose branchings therein we described in the former book, Chap. 16. *Of the Spleen.* Vas breve arteriosum.
Gastroepiplois sinistra.

All these Arteries spring from the *Cœliaca*, and accompany the Veins of the *Porta* of the like denomination.

The next that arises out of the trunk of the *Aorta* is the upper *Mesenterick*, which springs from the fore-part of it as the *Cœliack* did. It accompanies the *Vena mesaraica* of the *Porta*, and runs through all the upper part of the Mesentery, and bestows many branches on the Guts, *Jejunum*, *Ileum*, and that part of *Colon* that lieth in the right Hypochondre. 4. Mesenterica superior.

Immediately below this, about the second vertebra of the Loins, there go out of each side of the descending trunk of the *Aorta* an *Emulgent artery*, each of which being after its rise divided into two and sometimes three branches, enters the Kidney of its own side. The right springs out of it a little lower than the left. Both are subdivided into innumerable twigs in the *Parenchyma* of the Kidneys, (all of which are invested with the Veins in one common *capsula* borrowed from the *Pelvis*) and their Capillaries end in the Glands, wherein the *Serum* that these Arteries bring 5. Emulgentes.

bring with the Blood is separated therefrom, and carried from them by the urinary Siphons into the *Pelvis*, of which more in the former Book, Chap. 17. *Of the Kidneys*.

6. Spermatica.

Next to these arise the *Spermatice* (called *Arteria preparantes*.) These go out of the fore-part of the Trunk very near together (very seldom either of them out of the Emulgents, as the left Spermatick Vein does) and the right passes over the trunk of the *Vena cava*. About two fingers breadth from their rise they are each joined with the *Vena preparans* of their own side, and descend with them in *Men* through the process of the *Peritoneum* to the Stones, being divided into two branches a little before they arrive at them, one of which runs under the *Epididymis*, and the other to the *Testis*. In *Women*, when they come near the *Testes*, (or *Ovaria*) they are divided also into two branches, one whereof goes to the *Testis*, and the other to the bottom of the Womb.

7. Mesenterica inferior.

Next below the Spermatick springs the lower *Mesenterick* out of the Trunk a little before it is divided into the *Rami iliaci*. This entrench the lower region of the Mesentery, and distributes many branches to the left part of the *Colon* and to the streight Gut, and lastly descending to the *Anus* makes the internal hemorrhoidal Artery.

8. Lumbares.

Very near to this, out of the Trunk still, arise the *Lumbares*, reckoned four in number. These go out of the backside of the *Aorta*, and are distributed not onely to the neighbouring Muscles of the Loins, and to the *Peritoneum*, but enter in at the holes of the *Vertebra* of the Loins, and run along the Membrane that involves the spinal Marrow, and penetrate into the Marrow it self.

Besides

Besides these some reckon other two, on each side one, called *Musculæ superiores*, (which run to the Muscles of the *Abdomen*) unless these be two of the four called *Lumbares*.

When the Trunk is descended as low as the fifth or last *vertebra* of the Loins and the top of *Os sacrum*, it begins to climb upon the *Vena cavā*, under or behind which it passed thus far. But as it begins to get upon it, it is divided into two equal branches called *Rami iliaci*, and at its very division there springs out of it *Arteria sacra*, whose small twigs entring in at the holes of *Os sacrum* penetrate into the Marrow contained in it.

The Trunk of the descending *Aorta* being divided into the *Rami iliaci*, these are subdivided presently into the *interiour* and *exteriour* branches.

From the *interiour*, which is less, proceed three others.

First, the *inferiour Muscula* (called otherwise *Glutæa*) which is bestowed on the Muscles named *Glutæi* that make the Buttocks, and also on the lower end of the Iliack Muscle and the *Psoas*.

Secondly, the *Hypogastrick*, which is large, and at the lower end of *Os sacrum* runs to the Bladder and its Neck, and the Muscles that cover the *Ossa pubis*. In *Men* it goes also along the two nervous bodies of the *Penis* as far as the *Glans*: and in *Women* it is distributed in numerous branches into the bottom of the Womb and its Neck; out of which for the greatest part issue the *Menses* in their monthly purgation. It goes also to the *Podex*, where it makes the external hemorrhoidal Artery.

Thirdly, The *Umbilical Artery*, which ascending by the sides of the Bladder, and being inserted into the *Peritonæum*, proceeds betwixt the two membranes thereof to the Navel, out of which it passes

passes in a *Fœtus* in the Womb, and runs into the *Placenta uterina*, of which before, *Book I. Ch. 33*. But after the Infant is born, when there is no more use of it, it closes up, and turns into the nature of a Ligament, in some measure sustaining the sides of the Bladder, and hindring it from pressing on its Neck.

From the *exteriour branch* of the *Ramus iliaca* two Arteries arise.

4. *Epigastrica*.

First, The *Epigastrick*, which turning upwards on the outside of the *Peritoneum* runs betwixt it and the *Musculi recti* of the *Abdomen* as high as the Navel, where the Mammary Artery meets it, and according to tradition (though false) communicates there with it. Of which before, in the Chapter.

5. *Pudenda*.

Secondly, *Pudenda*, which sends forth a notable Artery on each side into the nervous body of the *Penis* in Men, and into the *Clitoris* in Women. Hence it is carried inwards by the jointing of the *Ossa pubis* to the *Pudenda* and Groins, and thence to the Glands, and is spent on the Skin of those parts, and of the Yard (in Men.)

When all these pairs of Arteries have arisen out of the *Rami iliaci*, they run down out of the *Abdomen* to the Thighs, where they begin to be called *Crurales*, where we shall leave them till we come to speak of the Arteries of the Limbs, *Book IV. Chap. 5*.

Having now traced all the Arteries springing out of the *Aorta* (whether out of its *ascending* or *descending* Trunk) in the *Thorax* and *Abdomen*, taking occasion to do so, because the *great Artery* out of which they all arise, has its Origin in the *Heart*, to which we have considered it as an Appendage; we shall pass on to the description of the remaining parts in the *Breast*, not yet spoken of.

Tab

II

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Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

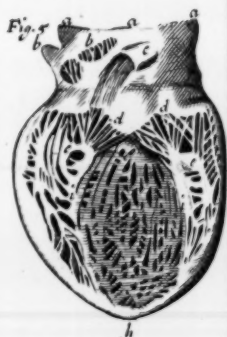


Fig. 6

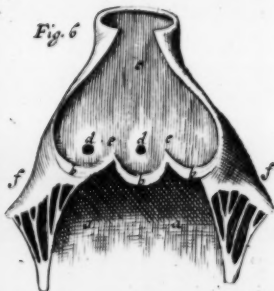


Fig. 7



Tab. XII.

Representeth the Fibres of the Heart, with its Auricles, Ventricles, Valves, &c. (from Dr. Lower.)

Fig. I. Sheweth the outmost or streight Fibres of the Heart.

a *The Basis of the Heart.*

b *Its Cone.*

c *The streight Fibres tending upwards towards the basis.*

Fig. II. Sheweth the second rank of Fibres (which are oblique) lying next under the former, which ascending obliquely from the left side towards the right, terminate in the basis of the Heart, imitating a Snail-shell, or Screw, by their spiral circuit.

a *The Basis of the Heart.*

b *The Cone.*

c *The Fibres that encompass the left Ventricle.*

d. *The Fibres encompassing the right.*

e *A Sinus in the interstice of the Ventricles, made for receiving the Vessels of the Heart.*

Fig. III. Sheweth the third or inmost rank of Fibres, which are oblique also, but run a contrary course to the former; for they arise every where from the right side of the Heart, whence being carried obliquely towards the left, and embracing each Ventricle of the Heart they ascend to the Basis of the left side.

- a *The Basis of the Heart.*
- b *The Cone.*
- c *The right side of the Heart.*
- d *The left.*
- e *The Fibres of the right Ventricle.*
- f *The Fibres of the left.*

Fig. IV. Shews the right Auricle of the Heart inverted and laid open.

- aaa *The Basis of the Auricle, where it is united to the Tendon of the Heart.*
- bbb *The tendinous Circle whereby it is distinguished from the Vena cava.*
- ccc *The carnosus Fibres which are carried to the diverse or opposite Tendons.*
- d *The Coronary Vein.*
- ee *Other lesser Veins appointed for bringing back the Blood which remains from the nutrition of the Heart.*
- f *The upper part of the Auricle.*

Fig. V. Shews the inner Sinus of the left Ventricle.

- aaa *The pulmonary Vein laid open before its entrance into the Heart.*
- b *The left Auricle of the Heart.*
- c *The Foramen ovale, whereby the Blood flows out of the Vena cava into the pulmonary Vein just before the door of the left Ventricle.*
- dd *The two Mitral Membranes or Valves.*
- ee *The fleshy Columns protuberating out of each side of the Ventricle.*
- g *The place under the Mitral Membranes where the Blood is sent forth into the Aorta.*
- h *The Cone of the Heart.*

iii The carnous Fibres running on every side through the whole circuit of the inside of the Ventricle.

Fig. VI. Sheweth the semilunar Valves at the rise of the Aorta out of the left Ventricle, (whereunto those at the rise of the pulmonary Artery out of the right Ventricle are like.)

aa Part of the left Ventricle laid open.

bbb The three semilunar Valves conceiding loosely that they may yield an Exit to the Blood bursting forth.

c The Trunk of the Aorta laid open.

dd The two coronary Arteries rising immediately without the semilunar Valves.

ee The root of the Aorta where it is united with the Tendon of the Heart.

ff The Mitral Membranes divided and turned back on each side, that the semilunar Valves may come into sight.

Fig. VII. Shews the semilunar Valves closed.

aaa The Trunk of the Aorta cut off at the root.

bbb The three semilunar Valves coming close to one another, and hindring the recourse of the Blood out of the Aorta into the Ventricle.

cc The two coronary Arteries.

CHAP. XII.

Of the Aspera Arteria and Lungs.

AS in the First Book, being to treat of the ^{The Wind-} Stomach, we first described the Gullet, ^{pipe,} which serves as a Tunnel to it; so the same rea-

son induces to begin with the *Wind-pipe*, called *Trachea* or *Aspera Arteria*, thereby to usher in the description of the *Lungs*, to which it performs the same office as the *Gullet* to the *Stomach*, this receiving in Air, as that does Meat and Drink.

*Its Figure
and Sub-
stance.*

The *Aspera Arteria* then is a long Pipe, consisting of Cartilages and Membranes, which beginning at the Throat or lower part of the Jaws, and lying upon the *Gullet* descends into the *Lungs*, through which it spreads in many branchings.

Parts.

1. *Larynx*.

It is commonly divided into two parts, the upper which is called *Larynx*, and the lower, that is named *Bronchus*. Of the former we shall speak in Chap. 14. where we shall treat of the parts contained in the Neck; of the other, here.

2. *Bronchus*.

By the *Bronchus* we mean all the *Trachea* besides the *Larynx*, as well before as after it arrive at the *Lungs*. It is joyned immediately to the *Larynx*, to whose lowest Cartilage all those of the *Bronchus* (so far as it rests upon the *Gullet*

*Its Cartila-
ges and
Membranes*

are assimilated. These Cartilages are like so many Ribs, Hoops or Rings, seated one below another at equal distances, and kept in their places by the inner Membrane of the *Trachea*, which fills up their Interstices and ties them one to another like a Ligament. Yet these Rings have not their circle intire, but on the back side of the *Bronchus* next the *Gullet*, that they might give way to the Meat in swallowing, they pass into a Membrane, which is the same with the inner Membrane that ties them together. So that they are in figure like the letter C. But this interstice in their circle which most Anatomists affirm to be membranous, *Casp. Bartholin* (after his Father) says is rather "carnous, for there are very plain "and remarkable carnous Fibres that run from "one side or end of the Cartilage across to the "other.

* other, which in expiration (especially violent)
 * contracting themselves draw the ends of the
 * Cartilages towards one another on each side,
 * and thereby straiten the Pipe of the *Trachea*.]
 And though the Cartilages so far as they are
 contiguous to the Gullet, are thus semilunar as it
 were ; yet those of the branches of the *Bronchus*
 within the Lungs have no interstice in their cir-
 cumference, being all cartilaginous, though not
 all of a circular figure, but some four-square,
 others triangular, &c. as *Diemerbroeck* observes.
 This inner Membrane is plentifully beset with
 miliary Glands, out of which a good part of that
 mucous matter that bedaubes its inside issues, for
 the lubricating of it. The outer Membrane helps
 to connect the Cartilages the more firmly one to
 another, and the whole *Trachea* to the neigh-
 bouring parts, that it may more safely and firm-
 ly descend into the *Thorax*. This is much thin-
 ner than the other : for the inner (according to
Dr. Willis) has two rows of muscular Fibres, the
 outer streight, the inner oblique ; the first by
 their contraction shorten the *Trachea*, the latter
 straiten it ; so that he thinks they assist expira-
 tion, especially when it is violent, as in coughing,
 hawking or the like. Yea he says, this inner Mem-
 brane has two others growing upon it as it were,
 one glandulous, and another vascular. Through
 this latter do the Blood-vessels and Nerves every-
 where run ; and the Glands placed in the for-
 mer receive and keep all the superfluous moisture
 or *lympha* deposited by the Arteries, which the
 Veins do not imbibe, till they can remand it by
 the Lympheducts (which spring from them ;)
 or if it be over plentiful, so that the Lympe-
 ducts cannot receive it all, then it issues both out
 of these Glands and out of the Arteries into the

Cavity of the Wind-pipe and causes a Catarrh. But the inside of this Membrane is naturally moist, being besmear'd with a fattish and mucous humour, to hinder its drying, and to make the voice smoother; so that when this humour is fretted off in Catarrhs, or the inside of this Membrane becomes rough from any cause, the voice becomes hoarse; and when it is dried by too much heat, as in Fevers, it becomes squeaking.

Vessels.

The *aspera Arteria* has *veins* from the external Jugulars. *Arteries* from the *Carotides*, and from the *Arteria bronchialis*, (first found out by *Frederick Ruysch*) which springs from the backside of the descending Trunk of the *Aorta*, a little above the lower intercostals. *Nerves* it receives from the recurring branches of the *par vagum*, which run mostly along its inner Membrane, whence it becomes so exquisitely sensible.

Division.

When it is descended as low as the fourth *vertebra* of the *Thorax*, it is divided into two Trunks, whereof one goes into the right lobe of the Lungs, the other into the left, and each is presently again divided into two, and those into others, till at last they end in very small branches, which are dispersed among the like branches of the pulmonary Artery and Vein, and end into and are continued with the little Bladders that make up the greatest part of the bulk of the *Lungs*. For

The Lungs.
Their Substance.

Though the *Lungs* (called in Greek *πνεύμων*, *πνέω* to breathe) have been held to be of a carious substance, not much unlike the Liver or Spleen; yet *Malpighius* hath discover'd them to be of a far other, namely soft, spongy and rare, made up of most thin and fine Membranes continued with the inner coat of the *Trachea*, which

Membranes

Membranes compose an infinite number of little round and hollow Bladders, so placed that there is an open passage from the *Trachea* out of one into another, and all terminate at the outer Membrane that incloseth the whole Lungs.

These *Bladders* though they are continued to the *Bronchia*, yet they have no Cartilages as those have; but though they are very fine, yet they have muscular Fibres, whereby they contract themselves in expiration, but not so close as to expell all the Air included in them; for if the Lungs had wholly subsided and fallen flat and close in expiration, they would have given some stop to the circulation of the Blood through them out of the pulmonary Artery into the Vein; whereas now that there remains still so much Air in these *Vesiculæ* as to keep the Lungs a little puff'd up and rare, the Blood can pass the more easily and swiftly through them.

That there are such Bladders annexed to the *Bronchia*, *Diemerbroeck* shews by two notable Stories: The one of a *Stone-cutter's* Man that died of an *Asthma*, in whom he found these *vesiculæ* so stuff'd with the dust of the hewn Stone, that when he cut his Lungs open, his Knife seem'd as if it went through an heap of Sand: The other of one that being employed to pick and cleanse Feathers, died of a long continued *Asthma*, and had these Bladders quite filled with the fine Dust or Down of the Feathers. From whence he concludes, That whereas in a natural State the Air in inspiration is received as well into these Bladders as the *Bronchia*, seeing they could not now admit any Air, being stuff'd with the aforesaid matters, the Patients were necessarily *Asthmatical*, and died so.

We

*Investing
Membrane.*

We said before that all these *Vesiculae* were invested with a common Membrane in the *superficies* of the Lungs; and this Dr. *Willis* will have double; The *outer* Tunicle is thin and smooth, which seems to be a fine texture of nervous filaments; the *inner* rough and thicker, consisting almost wholly of the extremities of the Vessels and *Vesiculae*; and through the little pits that are all over made in it by them, its inner *superficies* looks like an Hony-comb. This investing Membrane consisting thus of two Tunicles has many large Pores, but such as admit not any thing to pass from within outwards; for if one fill the Lungs newly taken out of a Sheep or the like (before they are cold) with a pair of Bellows, never so full of wind, there will none pass out of the Membrane, not so much as to make the flame of a Candle to wave: but on the other side they do admit even liquors to pass from without inwards; so when the Breast has been opened to let out matter in an *Empyema*, (which was too thick to be absorbed by the too narrow pores) and bitter cleansing injections have been squirted into the cavity of the *Thorax*, to clear it from the purulent matter stagnating in it, it has been observed that a good part of such injections have been hawk'd and cough'd up. And though some think that whensoever *Pus* is cough'd up, it is certainly bred in the Lungs themselves; yet I am of opinion that in an *Empyema* when it is thin, these Pores may be so large as to imbibe it even out of the cavity of the *Thorax*; otherwise I see not how any labouring of an *Empyema* should ever be cured without tapping: for of the two I think this a far more probable way to discharge the matter by, than that it should be imbib'd by the mouths of the Veins gaping (as is suppos'd) either in
the

the *superficies* of the *Pleura*, or *Diaphragm*. But to proceed.

The Lungs are *divided* into the right and left *Division*. part, being parted by the *Mediastinum*, and each part is otherwise called a *Lobe*. And because they are two, that have no communication one with the other (save in one common trunk of the *Trachea*, by which the Air comes into and goes out of them) hence in common speech we say *Lungs* in the plural. Each of these parts or Lobes is subdivided into two, sometimes three others, and those into many lesser Lobules, as may be seen in the following Figure taken from Dr. *Willis*.

The Lungs hang loose in the cavity of the *Thorax*, being suspended by the *Aspera Arteria* that runs every where through their substance, and is it self sustained by its connexion to the parts of the Neck. Preternaturally (though pretty often) they cleave by their outer *superficies* to the *Pleura*, and sometimes with their lower end to the *Diaphragm*.

They have all sorts of *Vessels*, that are common to them with other parts; but peculiar to themselves they have *Bronchia* or the branches of the Wind-pipe, for bringing in and carrying forth of Air.

Their *Arteries* and *Veins* are the *Arteria* and *Vena pulmonaris*, that accompany all the Divisions of the *Aspera Arteria* within their several Lobes. These are said to have many *Anastomoses* one with another, for the readier Circulation of the Blood through the Lungs; however, they are admirably interwoven one with another all through the coats of the *Vesiculæ*. But of these we discoursed so largely before, *Chap. 10.* that we shall say no more of them here. Besides these, that were all

all the sanguiferous Vessels Anatomists had observed to reach to the Lungs, there has of late been found out an Artery by *Frederick Ruysch* (which he calls *Arteria bronchialis*) that seems to convey Blood for the nourishment of the Lungs and *Bronchia*. But of this likewise before (in this Chapter.)

3. *Lympheducts.*

They have abundance of *Lympheducts* that attend upon the Veins and Arteries. Their small twigs running upon the outer *superficies* of the Lungs, towards their Root unite into several greater Trunks; which being inserted into the common thoracick Duct, discharge thereinto the *Lympha* imbibed by them in the Lungs. They may be made to appear very plain in the outward surface, if in dissecting a live Dog, one press upon the top of the thoracick Duct, so as nothing be poured from thence into the Subclavian Vein; for then the Lympheducts of the Lungs, seeing they cannot unload themselves into the common Duct that is now stoppt and full, will swell very much, and be very conspicuous. If these Lympheducts at any time be obstructed or broken, *Dr. Willis* thinks there often proceeds from thence a Dropsie of the Breast or Lungs; yea, Coughs and Phthical Distempers.

4. *Nerves.*

The last sort of Vessels dispersed in the Lungs are the *Nerves*. And these proceed from the recurring Nerves of the *Par vagum*, usually called the sixth Pair, but *Dr. Willis's* eighth, who says they are distributed all over the Lungs along with the sanguiferous Vessels and Ducts of the *Bronchia*, to supply Animal Spirits to the muscular Fibres of their Coats.

The *Action* to which they contribute is Respiration, of which in the next Chapter.

Fig. I.



Fig. II.

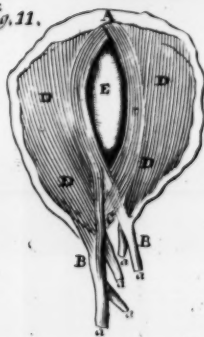
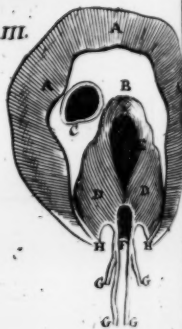


Fig. III.



Tab. XIII.

Representeth the Lungs, Diaphragm, Ductus salivialis, &c.

Fig. I. Representeth the Sternum cut off and lifted up, the Mediastinum, Thymus, Lungs, Diaphragm, &c.

AAA The inner superficies of the Sternum and of the Cartilages knit to it.

BB The mammary Veins and Arteries descending under the Sternum.

C The glandulous Body called Thymus.

DDDD The sides of the Mediastinum pull'd asunder from the Sternum.

EE The space between the Membranes of the Mediastinum, arising from the tearing of it from the Sternum.

GG The Lungs.

HH The Diaphragm.

I The Cartilago ensiformis.

K The external salival Duct.

Fig. II. Shews the Diaphragm of a Dog (very little differing from that of a Man) from Caspar Bartholin.

AAA Shew the courses of the carnos Fibres in the upper or fore Muscle, which run streight from the Ribs to the Centre or tendinous part of the Diaphragm.

B The Centre or tendinous part.

C The hole in the right side of the tendinous part for the transit of the ascending Trunk of Vena cava.

DD The

DD The lower or hinder Muscle of the Diaphragm.

E The hole in the upper part of the lower Muscle through which the Gullet descends.

F The hole in the hinder part of the lower Muscle through which the Aorta descends.

GGGG Its tendinous extremities whereby it adheres to the Vertebrae of the Loins, formerly called its processes.

Fig. III. Shews the lower or hinder Muscle of a Man's Diaphragm, something differing from that of a Dog, (from the same Author.)

A Shews the Tendon that intervenes betwixt the upper and lower Muscle, commonly called the nervous Centre of the Diaphragm.

BB The lower Tendons (commonly called its processes) which arise by five Heads as it were (aaaaa) from the Vertebrae of the Back and Loins.

C The hole by which the Aorta (lying along the Vertebrae of the Back and Loins) descends.

DDDD The fleshy Fibres of the lower Muscle in their natural and proper Course.

E The hole in its carnos part by which the Gullet descends.

CHAP. XIII.

Of Respiration.

The Action of the Lungs.

THE Action to which the Lungs are appointed by Nature to minister, is *Respiration*, which is an alternative *Diastole* and *Systole*, or dilatation

dilatation and contraction of the Breast, whereby the Air is received in, and driven forth of the Lungs.

In dilatation, whereby *inspiration* is performed, the Lungs are purely passive; for they do not at all dilate themselves by any proper power or faculty of their own, being destitute of instruments to perform such an action, (*viz.* Muscles;) neither do they attract the Air by any magnetick property: But the Muscles of the *Thorax* being so framed, that tho' contraction be the only and proper action of a Muscle, yet the *Thorax* is dilated by certain of them, as it is contracted by others; whilst it is dilated, there is greater space given for expanding the Lungs, and then the Air partly by the pressure of the Atmosphere, and partly by its proper elastick Virtue issues in at the *Trachea*, and insinuates it self into all its *Bronchia*, and through them into the *Vesicula*, and puffs them all up. The manner whereof is very ingeniously express'd by Dr. *Mayow*. "Namely seeing the Air thro' the weight of the superincumbent Atmosphere does not only rush into all empty places, but also strongly presses upon whatsoever things are next it; it follows that the Air which is continued thro' the Nostrils and *Trachea* even to the *Bronchia* or entrance of the Lungs, doth bear upon the Lungs from within, and endeavour an entrance into them. Whence it comes to pass, that, whilst the insides of the *Thorax* (which by compressing the Lungs from without resisted the pressure of that Air) are drawn outwards by the Muscles of the Breast that are appointed for its dilatation, and the width of the *Thorax* is enlarged, that Air which is nearest adjacent to the *ostia* of the *Bronchia* (all obstacles being now removed) rushes into the cavities
" of

How Respiration is performed.

“ of the Lungs with all the pressure of the Atmosphere, and puffing them up, occupies and fills the widened space of the *Thorax*. Nor does the pressure of the Atmosphere alone, avail to inspiration; but the Elastick Power of the Air also, whereby it endeavours to extend it self in *immensum*, is assisting to the same. For the Air, especially that which is nearest the earth, is compressed by the weight of the superincumbent; whence it always endeavours to free it self from that pressure, much like as a fleece of wooll, when the force that compress’d it is taken away, by a certain motion of restitution presently spreads and enlarges it self. Which may be confirmed by this known Experiment, *viz.* If a Bladder, out of which the Air is first in a great measure pressed, be tyed straitly about its sphincter (or neck) and put into a glass, and then the Air be drawn out of that glass, the Bladder will presently begin to swell and puff up to its first dimension. The reason whereof is, That the Air that was in it, though little, when the external Air (from whose pressure the same was driven into a narrow space) is removed, presently expands it self and puffs up the Bladder, yea, sometimes bursts it with violence. Just thus is the inflation of the Lungs caused in inspiration: for as soon as the sides of the *Thorax* (which by compressing the Lungs make them concide) are drawn outwards, the Air that is at the entrance of the Lungs, whether through the pressure of the Atmosphere, or because of its own Elastick virtue, is presently thrust into the Lungs, and distends them.] But in *Expiration* (or the contraction of the *Thorax*) the Air is not only driven forth of the Lungs by the compression of the *Thorax*, but also by the contraction

traction of the muscular Fibres of the *Vesiculæ* and of the inner coat of the *Trachea* and its *Bronchia*.

The *Muscles* that assist the dilatation of the Breast, are those that lift up the Ribs and draw them backwards; which shall be described *Book to Respiration.* V. Chap. 15. And besides these there is another internal Muscle, namely the Midriff, that contributes towards it, as was shewed Chap. 3. of this Book, where we treated of it. And as for the straitning or condensation of the *Thorax*, that it is not only a motion of restitution, or a cessation of the aforesaid Muscles from their action, is evident, seeing sometimes Expiration is performed more laboriously and violently than inspiration, as in coughing, hollooming, or the like: And therefore Nature has provided peculiar and proper Muscles for that purpose, described in the same Chapter of the *Fourth Book*; and these are assisted partly by some Muscles of the *Abdomen*, and partly by the muscular Fibres of the *Vesiculæ* and *Bronchia*, as above said.

There hath been great Controversie among Philosophers, whether Respiration be an Animal or Natural Motion. That it is *natural* is thought to be proved, both in that it is performed as well when we are asleep, as awake; and also that though it be continued through a Man's whole life, yet we are never wearied with it as we are with animal and voluntary motions. On the other side, some prove it to be *animal*: first because it is performed by such Instruments as serve for animal Motion, namely Muscles; and secondly because at our pleasure we can make it quicker or slower, stronger or weaker, or alter it how we please. Others thinking the Arguments on either side convincing, take both in, and suppose

What kind
of Motion
Respiration
is.

it a kind of *mixt* Action, partly natural, and partly spontaneous. But I think there is no necessity from the Arguments alledged to grant this motion to be *natural*, or any more than *animal* or *spontaneous*. For as to the *first* Argument, That the motion is as well performed when we sleep as when we are awake, and therefore it cannot be voluntary; if this were allowed to be of force, we must also grant walking and talking to be natural motions, because many perform them both when they are asleep. And as to the *second*, from our not being wearied by it, in Answer to it we may distinguish of animal actions, into such as are done by instinct and are free, and into such as serve the affections of the mind: the former proceed always and without impediment, even when we think not thereon, but may notwithstanding be directed and moderated when we do think of them, and such is Respiration; the latter is not performed continually, as to run, leap, write, &c. In the former there is a plentiful and continual influx of animal spirits into the Muscles, of custome or course; whence there follows no weariness, though they be continual. In the latter, seeing by the determination that is made in the Brain, the Spirits now flow in and anon cease, sometimes in greater plenty and sometimes in less, from this mutation and unaccustomedness does the weariness proceed.

The Use
of it.

Respiration is so necessary to the continuance of life, that after once the *Fœtus* comes into the open Air and begins to breathe, it can hardly live two minutes without it. But upon what account it becomes so necessary is not agreed among learned Men, each party exhibiting such reasons as it, as may best suit with their Hypotheses. Hence some (and those the most) think that Respiration

on serves for the cooling and ventilating of the Blood that acquires a great heat in the right Ventricle of the Heart, and also for the carrying out fuliginous steams therefrom. *Others*, that it serves for the better mixture of the particles of the Blood as it passes through the Lungs. *Others*, that it condenses the Blood, which was very much rarefied in the right Ventricle of the Heart, whereby it comes to take up less room in the Lungs, and passes the readilier through each Lobe into the left Ventricle. *Others*, that it principally serves for the Circulation of the Blood thro' the Lungs; For in Expiration all the *Bronchia* with the appendant *Vesiculæ* being in a great measure emptied of the Air, permit a free entrance of the Blood into the Lungs by the *Vena arteriosa* out of the right Ventricle of the Heart; but anon the said *Bronchia* and *Vesiculæ* being filled again with Air, do compress the Vessels of the Lungs, whereby the Blood that was received into them in Expiration, is squeezed out of the Arteries into the Veins, and so its Circulation thro' the Lungs promoted; whereas otherwise it would be apt to stagnate and occasion a suffocation. Dr. *Mayow* thinks that a double benefit, chiefly, accrues by Respiration; *first*, That the Blood by the admixture of the Nitro-aereal Particles of the Air is fermented, and freed from coagulation; and *secondly*, that the same Nitro-aereal Particles being received into the Blood are carried to the Brain for the refection and supply of the Animal Spirits. Lastly, Dr. *Willis*, Dr. *Charleston*, &c. think that the Air is drawn in for the greater subtilization of the Blood, and accending or continuing the vital Flame. Some other Opinions there are concerning the primary Use of Respiration, which we will not recite, as be-

ing less probable ; and which of these produced is the most likely, we leave the Reader to judge, being unwilling to enter into the dispute about so difficult a speculation in this short Anatomical Treatise.

Secondary Uses of Respiration are, *first*, to form the Voice ; and *secondly*, to minister to the Sense of Smelling by drawing or snuffing up the vapours with some violence through the Nostrils, without which the Organ of Smelling is but little affected. Which Use Dr. Needham draws from Dr. Lower's Experiment: who having cut a Dog's wind-pipe asunder in his throat, and turn'd it outward (the wound being in other regards heal'd up again) so that the Dog took not his breath by his mouth or nostrils, but altogether by his throat; found, that thereby he lost not his Voice onely, but his Smelling also wholly, so that the most stinking Smells would not excite him.

Tab. XIV.

Representeth one Lobe of the Lungs, with its Lobules, Membranous Interstices, &c. from Dr. Willis.

Fig. I. Sheweth one whole Lobe of the Lungs, in whose superficies the Lympheducts appear creeping this way and that way.

- A The orifice of the Trachea cut off, lying in the middle of the Vessels.
- B The orifice of the subjacent Pneumonick Artery.
- C The orifice of the Pneumonick Vein lying upon the Artery.

dddd, &c.

Fig. 1.



Fig. 4.

Fig. 3.



Fig. 2.



dddd, &c. *The outward Lymphducts dispersed thro' the surface of this Lobe.*

Fig. II. Expresses one Lobe of the Lungs divided into smaller and very little Lobules, according to the Ramifications of the *Aspera Arteria*, the Branchings and off-springs of which Vessel being first filled by a Liquor injected into them, and then severed from one another as to the Lobules, were drawn by the Life.

A *The Trunk of the Aspera Arteria, cut from the rest of its body.*

BBB *Its wider part cut open, that as well the Holes that lead into each Branch, as its streight muscular Fibres may be seen.*

aaa *The aforesaid Holes leading into the Branches that are extended this way and that way.*

bbb *The streight muscular Fibres, whereupon other circular ones lie.*

CC *The smaller end of this Trunk intire and shut, that the annular Cartilages may appear.*

DDDD *The Tracheal Branches, constituting the lesser Lobules, intire and shut in that place; that the Annular Cartilages may likewise appear in them.*

EEEE *The like Branches cut open, that the Holes and streight muscular Fibres may be seen.*

FFFF *The Stumps from which the Tracheal Branches being cut are removed, that Room may be granted to the rest expanding themselves after their Division.*

GGGG *The secondary Lobules hanging upon the stems of the Bronchia like Grapes, which may also be subdivided still into lesser Lobules, all whose*
A a 3 inner

inner Ducts pass out of the Bronchia into the Vesicular Cells.

HHHH *The sanguiferous Vessels creeping through the superficies of those Lobules.*

Fig. III. Expresses a piece of a Pulmonary Lobe, wherein the membranous Interstices being blown up, all the Lobules appear in their proper Figure, and somewhat represent a Leaf of Polypody.

AA *A piece of the Aspera Arteria complicated with the rest of the Vessels, upon which, made up of them all, the Lobules grow like the Leaves of a Tree.*

bbbb *The Lobules themselves.*

cccc *The Blood-vessels creeping through them.*

dddd *The membranous Interstices of the Lobules, through which the Blood-vessels eeee also creep.*

Fig. IV. Represents the divarication of a Tracheal Branch distributed within one Lobule, and its Ramification into the Tubes and orbicular Bladders.

AA *The stem of the Aspera Arteria.*

bbbb *The lesser twigs proceeding from that stem.*

cccc *The transit of these twigs into the orbicular Bladders which seem like bunches of Grapes.*

dd *Sanguiferous Vessels distinct from the Pneumonic, which creep upon the Trachea and serve to nourish it.*

C H A P. XIV.

Of the Neck and the Parts contained in it, viz. the Larynx, Pharynx, Tonsillæ, &c.

HAVING now dispatched all the parts of the *The Neck.* middle Venter or *Thorax*, we should next proceed to the highest, viz. the Head; but betwixt these two is the Neck situated, like an *Isthmus*, which therefore we must take in our way, and describe the parts contained in it.

It is called *Collum*, either à *Colendo*, because it *its name.* used to be adorned with Chains, &c. or because it riseth out of the Trunk of the Body *instar Collis* like an Hill. *Collum* is a general name for the whole Neck, but the hinder part of it is particularly called *Cervix*.

The parts of it are either *containing*, or *con-* *Parts con-*
tained. *taining.* The *containing* are the same which are found in the rest of the Body, and like them, saving that the *Membrana carnosæ* seemeth to be more fleshy.

The Parts *contained* are these.

1. The *Larynx*, which is the upper part of *Contained.* 1. *Larynx.* the Wind-pipe, and the Instrument of forming the Voice.

It is almost round and circular in *Figure*, onely *its Figure.* jetting out a little before, (and something flattish behind,) to give way to the Gullet in swallowing.

Its *Bigness* differs according to Age, Sex, and *Bigness.* Temperament, whence proceeds the great diversity of Voices. Such in whom it is narrow, as in younger People, have shrill and small Voices; such as have it wide and are come to Maturity,

have fuller and more hoarse. The Voice is altered also in respect of the length or shortness of the *Larynx*, and as the Air is more strongly or weakly expelled.

Vessels.

It has *Arteries* from the *Carotides*, *Veins* from the external Jugulars, and *Nerves* from the recurring Branches of *par vagum*.

Substance.

Besides the Membranes which are common to it with the rest of the *Trachea* (described before, Chap. 12.) it is made up of five Cartilages and thirteen Muscles.

Cartilages.

The first Cartilage is called *Supracricoides*, *scutiformis*, or Buckler-like; for within it is hollow, but without imbossed or convex: that part which sticketh out is called *pomum Adami*, from an idle Fable, That part of the fatal Apple by God's judgment stuck in his Throat, and that this Cartilage being thereby distended was made to jet out, and the protuberance propagated to Posterity. It is greater in Men than in Women. In its corners it has four Processes, two longer ones above, whereby it is joined to the lower sides of the *thyroideæ* by the help of a Ligament; and two below, by which it adheres to the Cartilage next below it. At the sides of this Cartilage, and the following, are the Glands placed, called *thyroideæ*, which Dr. Wharton says, are of the shape of a Pear or Fig, being somewhat hollow on that side next the *Aspera Arteria*, and somewhat coped on their outer side. Their substance is more solid than that of other Glands, and liker to muscular flesh, though it be not fibrous. They contribute to the roundness of the Neck by filling up the empty spaces about the *Larynx*; and the humour separated in them seems to serve for the lubricating of the *Larynx*; whereby the voice may be made more smooth and sweet.

The *second* Cartilage is called *κρινειδής*, *annularis*, because it is like a Turkish *ring*, and compasseth the whole *Larynx*; in the hinder part it is broad and thick.

The *third* and *fourth*, because of the Membrane that invests them, seem but one; but it being removed, they appear to be two. However they have but one name which is *ἀφραίνουσις*, *guttalis*, because when their two processes are joined together, they are *instar gutturnii*, like to that part of the neck of a Jug or Ewer at which we pour out the water. For by their juncture they frame a *rimula* or little chink (for the modulating of the voice) called *Glottis*.

The *fifth* is called *Epiglottis*, because it is placed above the *Glottis* or Chink, and covereth it. It is of the form of a Tongue, and is appointed to hinder the falling down of any thing which may prove offensive unto the Windpipe, when we eat or drink. It is pressed down by the weight of the things which are swallowed, for they slip over it down into the *Gula*. *Steno* takes notice of little holes or pipes perforating this Cartilage, which, he says, spring from certain caruncles on its upper side, from whence they evacuate an humour on the other side looking towards the *Larynx*.

The *Muscles* by which these Cartilages are moved in forming the voice, are thirteen in number: but as for their names and description, the Reader may please to consult Book V. Chap. 11. *Muscles.*

The second part contained in the Neck is the upper part of the Gullet, which is called *Pharynx*, *2. Pharynx.* from *φάρω*, because it conveyeth the meat and Drink towards the Stomach. It is continued to the *Fauces*, (or indeed is the greatest part thereof)

of) reaching up behind to the *Uvula*, on the sides to the *Tonsillæ*, and before to the *Epiglottis*. It is membranous; but not purely so, for it is thick and in some sort carnosous. It has seven Muscles, to assist it in swallowing, three pair to open it; and an odd one, which is called its Sphincter, to straiten it; of which afterwards
Book V. Chap. 12.

3. Tonsil-
lar.

The next parts are the *Tonsillæ*, commonly called *Almonds*, which are two Glands seated at the root of the Tongue, on each side of the *Uvula*, and at the top of the *Larynx*, covered with the common Membrane that invests all the Mouth. Dr *Wharton* says, that though they seem two, yet they are really but one, being continued to one another by a thin and broad production which is of the same glandulous substance with themselves. He says they are of a yellowish colour, and compares their substance to concremented Honey, only they are of a more firm consistency, but they look sandy like it: They have small Vessels from the Jugular *Veins* and *Arteries*, and *Nerves* from the fifth pair.

Their Duct. They have each a large oval common Duct or *Sinus* that opens into the Mouth, so wide in an Oxe that one may put the tip of the little finger into it. Into this many lesser open, and by it discharge into the Mouth, &c. the liquor that is separated in the Gland. *Fallopins* hath observed this aperture or *Sinus* to look like a small ulcer when the Gland has been swelled, and sometimes by unskilful Persons to have been treated as such, when it has only been forced to gape a little too much through the too plentiful defluxion of Humours upon the Gland.

The

The Use of these Glands was by the Ancients *Use.* supposed to be only to separate a certain mucous or pituitous matter from the Blood, for the moistening and lubricating of the *Larynx*, Tongue, *Fauces* and Gullet: but Dr. *Wharton*, and as many as attribute a fermentative quality to the *Salivæ*, ascribe a more noble use to them; *viz.* to make a Ferment to further the concoction of the Stomach: yea, Dr. *Wharton*, (but I think mistakingly) thinks that they are the chief Instrument of Taste.

Besides these there are other Glands in the Neck, 4. Glands which from their situation Dr. *Wharton* calls *Jugulæ Jugulares*; for they are seated by the sides of the Jugular Vessels. He says he has observed them to be fourteen on each side, besides another longish one separated from the rest, lurking on each side at the root of the *processus styloides* between the Muscles of the Neck and Jugular Vessels. The uppermost are palest of colour, and the lower the redder. They grow in knots as it were, and are of an unequal bigness, varying from the smallness of Coriander-seed to the bigness of a Bean. They have no proper excretory vessel, and so are of the nature of conglobate Glands, which return the *Lympha* by the Lympheducts into the Blood. Among or near unto these Glands are commonly those strumous swellings that are so frequent in the Neck.

As for those other Glands which are commonly reckoned as Parts contained in the Neck, *viz.* the *Maxillar* and *Parotides*; because their excretory Vessels discharge that liquor that is separated in them into the Mouth, we shall defer the description of them to the *Twenty sixth Chapter* of the *Third Book* which treats of the inner parts of the Mouth. Neither shall we here mention the Veins and

and Arteries that pass through the Neck to the Head, having described them before, in Chap. 9. and 11.

And as to other Parts that make up the Neck viz. the seven *Vertebrae*, and eight Muscles, those will come to be treated of in their proper Books: And therefore omitting them here, we shall pass on to the *Head*.

The End of the Second Book.

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The Third Book.

OF THE HEAD.

CHAP. I.

Of the Head in general, and its common containing Parts.

NOW followeth the third and highest *The Head.*
Venter of the Body, called *Caput*, the
 Head. This is the most noble Cavity
 of the three, containing the Brain,
 wherein the rational Soul more especially operates,
 and whereby all the animal motions of the
 whole Body are moderated and determined; as
 well as performed by means of the Spirits elaborated
 in it, and sent into all the parts by the
 Nerves.

It is *seated* in the highest place of the Body, because *its Seat.*
 it contains the Organs of the Senses, most
 of which perform their office more advantageously
 by this sublime situation. For from hence
 the Eyes can behold things remote, as from a
 Watch-tower; here the Ears draw in the sounds
 that fly aloft; and the Nostrils receive the
 ascending Odours.

Its figure is spherical; yet somewhat flattish, *Figure.*
 and longish.

It

Bigness.

It is bigger in Man than in other Creatures considering the proportion of their Bodies; his Brain that is contained in it, also is.

Parts.

The parts are of three sorts, for they are either
1. distinctive, or 2. expressive of the regions, or
3. constitutive of the whole.

The parts *distinctive* are two, the hairy scalp called *Calva*, and that without hair called *Facies*.

The parts which *express* the regions (of the first,) are four: 1. *Sinciput* or the fore-part, reaching from the Forehead to the coronal suture. 2. *Occiput* the Noddle, or hinder part, beginning at the suture *Lambdoides*, and reaching to the first *vertebra* of the Neck. 3. *Vertex*, the Crown, which is situated on the top of the Head between the bounds of the *Sinciput* and *Occiput*. 4. the lateral parts descending from this on each side between the Ears and Eyes, called *Tempora* or the Temples.

The parts *constitutive* are either containing, or contained. The containing are either common or proper. The common are those we treated of in Chap. 3. of the First Book. The *Cuticula* is thinner and softer; but the Skin thicker than in any other part of the Body, yet porous, that room may be left for the Hair to grow, and for its nourishment to pass to it. The *Membrana carnosissima* aboundeth so with Muscular Fibres, and cleaveth so close to the Skin, that they can move it at their pleasure.

We shall not need to say more here of these or of other the common containing parts, but refer the Reader to the above-cited place: and now proceed to the proper, having first discoursed a little of the *Hair*.

C H A P. II.

Of the Hair.

THE Hairs of the Head are called in Latin *The Head.*
Capilli, quasi *Capitis pili*, and differ not from *its name.*
 the Hairs in any other part of the Body, save in
 length.

Now an *Hair* may be defined to be a *body cold Definition.*
and dry, small, thread-like, hard and flexible, bud-
ing from the Skin.

The Hairs are seldom round, but generally *Figure.*
 four-square, as the stalks of some Plants; some-
 times triangular, but always porous, the pores
 running length-ways. All these things may be
 observed by the help of a good Microscope.
 They are sometimes curled, and sometimes hang
 blank.

Hairs are commonly divided into *Congeniti*, such *Divison.*
 as we bring into the World with us, as those of
 the Head, Eyelids, and Eyebrows; and *Post-*
geniti, such as begin to grow at certain seasons in
 our life-time, as the Beard, the Hairs growing
 about the *Pudenda*, on the Breast, in the Armpits,
 and the like.

They are no parts of the Body, and therefore *Life.*
 have no *Animal* life; yet they have a *Vegetative*
 life, and that peculiar to themselves, and not
 owing to the life of the Body; seeing they conti-
 nue to grow after a Man is dead, as has been ob-
 served in embalmed Bodies. *Diemerbroeck* (and
 before him *Malpighius*) ingeniously compares them
 to Polypody, or some other Plant growing upon
 an old Tree, which continue to grow after the
 Tree is dead as they did before, because they
 have

have a proper life distinct from the form or *anima* of the Tree out of which and in which they grow.

*Generation
& Nourish-
ment.*

The matter out of which they are bred and nourished is commonly reputed to be a moist, fuliginous, crass, earthy and somewhat viscid excrement of the third concoction. *Spigelius* thinks they are nourished by Blood : which opinion he grounds on an analogy he supposes there is between Hair, and the Feathers of Fowl ; and these latter he says are apparently nourished by Blood, for if one pull one from off a young Fowl, its end is bloody. *Diemerbroeck* dissents not much herefrom ; but thinks the Blood to be prepared and concocted in a specifical manner into a crass, earthy and viscid juice. Whatever the matter of their nourishment be, it is attracted by the white roots of the Hairs, and is carried even to their very ends by the pores ; just as Plants receive nourishment out of the Earth by their Roots, and communicate it to their outmost parts. *Malpighius* says, their head or root being round and mucous, is set in a kind of Oval-Case, (as in a Flower-pot) to which case a Nerve is evidently propagated.

Colour.

The colour of them differs according to the Climate, or to the natural constitution of the party, or to the diversity of those humours that are mixed with the juice whereby they are nourished. In those of cold flegmatick constitutions they use to be of a light colour ; in cholerick, reddish, &c. They are most commonly streight in those which are born in cold Countries, but curled in those who inhabit hot Climates.

*Why Hair
turns white.*

And as the reason of the difference of the colour of the Hair in several persons is from different temperaments, &c. so the reason why Men

in old Age grow grey, whenas their Hair before was of another colour, seemeth to be the predominance of flegm in that juice that nourisheth them: whence also the Hairs of the Head and Face soonest turn white, because the Brain does more abound with pituitous humours than any other part of the Body. But it is not so easie to give a reason of some Mens turning grey in one nights time, when they have been under great fears; (of which there are many instances credibly reported.) Yet *Diemerbroeck* gives a reason somewhat probable, *viz.* "That in great fear and terror, the heart by accident is in great anguish, whence it beats little and very weakly, so that some from this cause fall into a swoon: by reason of the weak pulse little blood is impelled into the outer parts, whence by and by they grow cold and stiff; blood failing in the Skin, the colour also in the juice that nourisheth the Hair, is by and by changed from that which before was induc'd upon it from the humours mingled with the blood: Then if by chance whitish pituitous humours stuck before in the Skin, they will presently infect the juice that nourisheth the Hair with the prevalence of their own colour, which juice passing through the Hair continually even to their end, and nourishing them, their Colour may from hence be changed in a short time, and become white, seeing their substance is diaphanous as it were, easily admitting of any Colour which is communicated to it with the nourishment.] See his *Anat. corp. human.* p. 559, 560. where he answers some Objections that may be made against this Opinion.

Their Use. The Hairs have three *Uses* : for they serve, 1. for Defence, 2. for Beauty, and 3. shew the temperature of the whole Body and Skin.

CH A P. III.

Of the proper containing Parts.

TH E proper containing Parts are six ; to wit, the *Muscles*, the *Pericranium*, the *Periosteum*, the *Cranium*, and the two *Meninges*. Look for the *Muscles* in the *Fifth Book*, and for the *Cranium* in the *Sixth*. Of the other here. And First,

*The Peri-
cranium.*

The *Pericranium* (which is so called from its being extended *περὶ τὸ κρανίον* about the Skull) is a Membrane somewhat thin, dense and white, of exquisite sense, immediately seated under the *Membrana carnosæ*. It covereth the whole Skull next above the *Periosteum*, except where the temporal Muscles lie upon the *Cranium*, for it is stretched over them ; and seeing it is very sensible and tender, it causeth horrible pain and inflammation, when the temporal Muscle is wounded.

*Its Conne-
xion.*

It is knit to the *Dura Mater* by some nervous Fibres, which pass from it to within the Skull by its sutures, to stay firmly the *Dura Mater*, and also the Brain which it invests, from violent concussion. For though in Infants new-born these be strongly united and in a manner continued, inso- much that the *Pericranium* is said by some to spring from the *Dura Mater* ; yet in process of time they part so, as to be knit to one another only by these nervous Fibres, by which yet, inflammations

ons may be communicated from the *Pericranium* to the Brain.

Next under the *Pericranium* is spread the *Periosteum*, which immediately cleaveth to the Skull, and gives it that sense which it hath. It self is a very thin and nervous Membrane, and of very acute sense. All the Bones of the whole Body (except the Teeth) are invested with such alike Membrane, and owe their sense to it. Dr. *Havers* thinks, "there is little reason to make the *pericranium* a distinct membrane from the *periosteum* of the Skull. For although it be divided at the temporal Muscles; this is no more than what the several series of fibres do make the *periosteum* capable of in the Leg, or any other part; and I have upon the shin-bone of an Ox divided it into four or five several membranes, if I may so call them, when it has been dried.] To this I answer, that though the *periosteum* may every where be divisible; Yet Nature having divided it in no other place, I think 'tis more reasonable to adhere to the former opinion, than to believe she does any thing singular here.

These two Membranes outwardly investing the *Cranium* have *Arteries* from a branch of the external *Carotides*, and *Veins* from the external *Jugulars*.

The *Meninges* follow, called by the *Arabians* The *Matres*; as if all the Membranes of the Body were propagated from them. These are immediately within the Skull, as the other were without; but adhere not close thereto, as those do. They are two in number: the *Crassa Meninx* or *Dura Mater*, and the *Tenuis Meninx* or *Pia Mater*.

Dura Mater.

The *Dura Mater* is the outer, that is, is next to the Skull, through whose Sutures sending Fibres to (or receiving them from) the *Pericranium*, it is suspended thereby; for in other places it is loose from the *Cranium*, saving in its *basis*, to which it is so firmly knit, that it can hardly be pulled from it; or where it is suspended by Vessels entering into it from the perforations of the Skull; or lastly where it adheres to the *Os cribriforme* at the top of the Nose, and sends jags through its holes. It is thicker and harder than the inner, whence it has the Epithet of *Dura*, hard. It consists of a double Membrane, the outer of which is more rough, towards the *Cranium*, having very small and hardly visible fibres: the inner on its superficies next the *Pia Mater* is more smooth and slippery, being bedewed with a kind of water, and has very strong and large fibres. This inside is loose, saving that near the *Sinus's* it is knit to the *Pia Mater* by the insertions of the Veins, and in the *Basis* of the Skull by the Arteries and Nerves.

its Holes.

It has many *foramina* or holes for the transit of the Vessels; and besides, one very large one in its *Basis* for the descent of the spinal Marrow, and another small one which forms the upper orifice of the *Infundibulum*.

Vessels.
Arteries.

It has *Arteries* from the larger branches of the internal *Carotides*, (entering into it through the holes of the wedge-like Bone) and *Veins* from the internal Jugulars. The Veins Dr. Ridley (in his *Anatomy of the Brain*) says, run for some space betwixt its two *laminae* (as he calls them) or membranes, after the manner of the Ureters in the bladder, in large trunks, before they enter the *sinus's* by and by to be described. Dr. Willis observes, That its outer superficies has no where

Veins.

So many twigs of Veins as of Arteries; but that out of its four *sinus's* (which are the venous receptacles of the Blood) more Veins go forth through its *inner superficies*, which being presently inserted into the *Pia Mater* are dispersed all over it, and every where meeting the Arteries ascending from the *Basis* of the Head, and being branched with them, make manifold *plexus* of Vessels. Dr *Ridley* says, this Membrane has plenty of *Nerves* from the *Nerves*. foremost branch of the fifth pair, and is thereby made very sensible.

At the Crown of the Head it is doubled; *Falx*. and its duplicature descending inwards, divides the Brain into the right and left side: yet its descent is not quite to the *Basis* of the Brain, but only through the cortical part; for toward the *Basis* both sides of the Brain are contiguous to one another, making one continued Body, namely that part of it which is called *Corpus callosum*, of which in the next *Chapter*. This duplicature, because it is broader backwards, and grows narrower forwards, and so resembles in some manner a Reaper's Sickle, is called *Falx*. Now this *Falx* reaches as far forwards as to the top of the Nose, where it is knit to the upper process of the *Os cribriforme* that stands up betwixt the *Processus mammillares*, and is called *Galli crista* or Cock's Comb. But its hinder and broader part towards the *Occiput* being severed, descends towards both the right and left side, and parts the *Cerebellum* from the *Cerebrum*.

In the said duplicature are formed four *Sinus's* ^{*Sinus*} or Cavities, three pretty large, and one little one, which (as also the rest which he mentions) Dr. *Ridley* looks upon no other than large Veins. The first, which is the highest and longest runs along the upper part of the *Falx*, from the

top of the Nose lengthways of the Head towards the *Occiput*, where it is divided into two lateral *Sinus's* which descend by the sides of the *Lambdoidal Suture* to the *Basis* of the *Occiput*. And at the said division the fourth short *Sinus* proceeds inwards from it betwixt the Brain and Cerebel to the *Glandula pinealis*. This place, where all the *Sinus's* are continuous to one another, is called *Torcular*, the Wine-press. Some Anatomists describe several other.

Their uses. Into these Cavities the Mouths both of Arteries and Veins are said to open; by the former whereof Blood is extravasated into them, and absorbed again out of them by the latter. Whence if one open the Skull of a live-Creature, one may observe a beating in the long uppermost *Sinus*, from the Blood discharged into it by the Arteries. Dr. *Higmore* thinks, that much blood being sent to the Brain by the *Carotides*, all of which is not fit to have Animal spirits elaborated out of it; that part of it which is less fit and necessary for this purpose, is discharged into these *Sinus's* to be returned by the Veins; even as a notable branch of the *Cœliack Artery* (when it is come just to the Spleen) is implanted into the *Ramus splenicus* of *Vena portæ*, by which that Arterial blood that is unmeet or unnecessary for the making of that juice (whatsoever it be) which is excocted in the Spleen, may be remanded back again. And some are of opinion that the Veins also convey some blood into these *Sinus's*, which being superfluous to the nourishment of the Brain and *Meninges*, is poured in hither by the Veins from their respective parts, and is imbibed again by other Veins whose mouths gape into them, (namely the branches of the internal Jugulars) to be returned to the Heart.

The second (and inner) Membrane investing *Pia Mater*. the *Brain* is called *Tenuis Meninx* or *Pia Mater*. This is of most exquisite sense, and endowed with very many Arteries and Veins. It immediately cloaths the *Brain*, and hinders it from running about, and also involves all its windings and circuits, and tying their summities together makes all the superficies of the *Brain* plain as it were : which upper connexion being loosed, the windings of the *Brain*, being all invested apart with this Membrane, may easily be separated and laid open. But (according to most Anatomists) it is only the Cortical part of the *Brain* which this Membrane cloaths thus ; for the inner surface of the expanded *Brain* (which is called *Corpus callosum*) is not invested by it ; but instead of it (Dr. *Willis* says) “ Many plexus of Vessels, commonly called *Choroïdes*, are suspended within its complicateure, and fluctuate as it were freely. But “ within all the other recesses of the *Brain*, and “ besides, within the *Plicæ* or *Lamellæ* of the *Cerebel*, yea, within the interstices of each of them “ and of the *Medulla oblongata*, does this Membrane insinuate it self.] Yet Dr. *Ridley* affirms, that it is extended also over the *Corpus callosum* it self (though loosely.)

This Membrane consists also of two coats (or *Laminae*) betwixt which the blood-vessels run, and ^{its Vessels} make many admirable plexus. The *Arteries* are ^{and their} Plexus. four, viz. two *Carotides* and two *Vertebrals*. The *Vertebral* Arteries being united at the *Basis* of the Skull, and making a single trunk, it meets and joins with the hinder branches of the *Carotides*; and from the place of their coalition a very remarkable branch ascends on either side under the *limbus* of the *Brain*, which being carried above the *crura* of the *Medulla oblongata* is divided into very many

B b 4 slender

slender and as it were capillary twigs, some of which ascend to the Glands seated behind the Cerebrum, and the rest make the Arterial part of the *Plexus Choroides*. The fore branches of the *Carotides* do also unite one with the other; and both before and after their joining send forth twigs all over this Membrane, but chiefly in the fore-part of the Brain. Its *Veins* arise from the four *Sinus's* of the *Dura Mater*, (as was observed above from Dr. Willis) and these meeting with one another are diversly interwoven one with another and with the Arteries, and return the superfluous Blood by the Jugular Veins to the Heart.

Note, That these two Membranes (the *Dura* and *Pia Mater*) not only invest the Brain, but the Spinal Marrow also, and all the Nerves that spring from either: And that the inner coat of the *Pia Mater* yields a covering to every single *Fibrilla* that each Nerve is made up of, whence comes the consent betwixt part and part, and betwixt all and the Brain.

CHAP. IV.

Of the Brain in general.

The Brain. **T**HE *Pia Mater* being taken away, the Brain occurs next; by which here we mean in the general, all that soft substance which is contained within the whole Skull, and which the Greeks comprehend under the word *ἐγκεφαλον*. It is the general Organ of sense, in which the Soul, the Governour of the Body, perceives and judgeth of the Sensations of all sentient Parts; and out of which, as out of a Fountain, it communicateth the Animal Spirits (bred in the Brain) by the

the Ducts or Rivulets of the Nerves to all the sentient parts of the Body, and thereby endows them with the Faculty of performing Animal Actions.

The Brain being of so loose a Substance, and the Skull wherein it is inclosed, so hard, that the Saw or Chizzel are necessary to break through it, the Brain must needs be very much shatter'd and concussed thereby; and after the Skull is divided, in the very pulling of it off, the vascular connexion of the *Dura Mater* and it with the *Pia Mater* and Brain, (and that also of the one with the other) being torn in sunder, the parts into which the Vessels are inserted, are necessarily much violated: and lastly, after the covers are removed, several parts of the Brain being of such difficult access, that others must be quite spoiled, before one can come to a view of them, and these also thereby in part violated: Upon all these accounts a true Anatomy of the Brain, as to its Contiguities, Connexions, Cavities or Ventricles, &c. must be very difficult; so that 'tis no wonder the observations of Anatomists are so different, and so opposite to one another. But this by the bye. Pass we on now to discourse of the Brain more generally.

If by Brain we understand the whole *Encephalos*, (or all that which is contained within the Skull) it is not of one Substance, but divers: And is distinguished by the particular names of the *Cerebrum*, (in special) the *Cerebellum*, and the *Medulla oblongata*. Nor is the *Cerebrum* (properly so called) it self of a like substance, but consisting of a Cortical, and a Medullar part, (called *Corpus Callosum*) these differ in their nature, colour and consistence. Which difference *Malpighius* thus describes, The Cortex (being of an Ash-colour) he says,

says, " is glandulous. The outside of the Glands
 " is covered with the *Pia Mater*, and its Blood-
 " vessels, which penetrate deep into their Sub-
 " stance; (each Gland having a twig of both an
 " Artery and a Vein:) their inner side sends
 " forth a white nervous Fibre, like a proper Ves-
 " sel as it were, so far as their brightness and
 " whiteness permit one to discover. These Fi-
 " bres make up all the *Pith* (or *Corpus callosum*)
 " which is of a more close and solid Substance
 " than the *Cortex*. They are flattishly round,
 " and are not unlike those white Bodies, or
 " *Intestinula*, which the Testicles are made up
 " of; and in the Ventricles of the Brains of Fish
 " they are so apparent, that if you hold them be-
 " twixt you and the light, they represent the
 " small teeth of an Ivory Comb. He saith they
 " are inserted by their ends into (or rather arise
 " out of) the *Cortex* or ash-coloured outer part
 " of the Brain, and seem all of them to have
 " their egress out of (or rather ingress into) the
 " trunk of the spinal Marrow within the Skull.
 Whether they be hollow or not, or whether as
 they are collected into a bundle they have not
 Pores and Interstices arising therefrom, which
 transmit a peculiar juice into the Nerves conti-
 nued to them, he leaves undetermined; because
 they neither admit of ligature, nor can sensibly
 make any discovery thereof. Dr. Ridley (from
Lewenboeck) offers at a yet finer description of
 these two parts of the Brain, which the curious
 Reader may find in his *Anatomy of the Brain*, p.
 89, &c. As for the other parts of the *Encephalon*,
 viz. the Cerebel and *Medulla oblongata*, their
 Substance shall be treated of afterwards, when we
 come to their Description.

The Brain receives Blood by *Arteries* derived *Vessels*. from the *Carotides* and *Cervical*, whose *Capillaries* are dispersed chiefly through its cortical part. These *Arteries* are so large and numerous, that a third part at least of the whole Mass of Blood is conveyed hither by them; which seeing through the smallness of the Brain it cannot be consumed in its Nutrition, *Malpighius* thinks it probable that the coagulative (or concrescible) *Serum* is filtered as it were in the *Cortex* (or glandulous part) of the Brain from the Arterial Blood, and that the *Fibres* of the *Corpus Callosum*, as so many roots implanted into the said *Cortex*, imbibe this *Serum* and convey it to the *Medulla oblongata* as the trunk, from whence it is derived into the *Nerves* as the branches, and is there the *Succus Nervosus*, if not the Animal Spirit it self. Part nourishes the Brain it self, and what is superfluous to both these Uses, is partly resumed by the *Veins* of the *Meninges* (whose twigs reach to the several Glands of the *Cortex*) and partly deposited in the *Sinus's* of the *Dura Mater* by the *Arteries* themselves, out of which it is resorbed by the internal branches of the *Jugulars*, and thereby conveyed back to the Heart. The *Arteries* inosculate one with another (*i. e.* the right *Carotides* with the left) and so do the *Veins* also; but not the *Arteries* with the *Veins*. It is from the Pulse of the *Arteries* altogether, that the beating (or *Systole* and *Diastole* as it were) of the Brain proceedeth.

A Man of all other living Creatures hath the *Biggest Brain*; for it weigheth four or five pound in some; and is as big again as an Oxe's Brain.

The outer surface is full of Windings, like *Figure*. those of the Guts, which are severally invested with

says, " is glandulous. The outside of the Glands
" is covered with the *Pia Mater*, and its Blood-
" vessels, which penetrate deep into their Sub-
" stance; (each Gland having a twig of both an
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The outer surface is full of Windings, like *Figure*. those of the Guts, which are severally invested with

with the *Pia Mater*, as also tied together by it. The whole Brain is much of the same *Shape* with the Head, *viz.* roundish, but with bunchings out towards the Forehead.

Of its *Action* we shall speak in the Ninth Chapter.

CHAP. V.

Of the manner of dissecting the Brain: of the Brain properly so called, the Fornix, Septum, and the three Ventricles.

There are several methods of dissecting the Brain; some beginning at the Crown, which was the old way; some on the right side, as *Sylvius*; and some behind, as Dr. *Willis*, whose Anatomy of the Brain being much more accurate than that of any before him, we will endeavour to give a short but faithful abstract of it.

*The manner
of dissecting
the Brain.*

Having taken out of the Skull the whole *Encephalos*, or all that which is contained under the name *Brain* taken in a large sense, first of all let the hinder *limbus* or bordure of the Brain properly so called, where it is knit to the *Cerebellum* and *Medulla oblongata*, be freed as clear as may be from its cohesion with the subjacent parts, cutting asunder the vessels and the membranes on every hand, for by these onely is it joined to them. Its hinder part being thus loosened, lift it up and turn it forwards, whereby the Crown of the *Medulla oblongata* will lie bare, and the three *Ventricles* of the Brain, commonly so called, will become one empty space, as being a vacancy resulting

resulting merely from the complication of the Brain. Moreover one may then see, how the two tips of the *Crura* of the *Medulla oblongata* are knit in two places to the *Corpus callosum* or medullar part of the Brain; as also observe the *Fornix* so called, how it is like a *subtensa*, or line drawn under the arch of a circle, which beginning before, where the aforesaid tips of the *Crura* adhere to the Brain, runs to the Brain's hinder bordure, to which it is united by two stretched out arms as it were, and so keeps the whole *compages* of the Brain in a spherical figure, hindring it from spreading into a plane, and ties it firmly to the *Crura* of the *Medulla oblongata*.

This is Dr. Willis's manner of dissection, wherein the parts occur to the Dissectors inspection in this order.

First the *Brain* it self, whose outer surface is The Brain all full of windings, like the convolutions of the properly so *Cuts*: It is exactly divided by the *Falx* (above-called. described) into two hemispheres, a right and left; and these are imperfectly subdivided each into two Lobes, a fore and an hinder, by a large branch of the Carotid Artery running cross the middle of them. How deep the *Falx* enters into the Brain, and of what substance the Brain is, has been shewn in the former Chapters: We shall only further note here concerning its substance, that its medullar part (or *Corpus callosum*) is both thicker and closer by much in the fore parts of each hemisphere than any where else; and that where it is thickest, it adheres on each side to the tips of the *Crura* of the *Medulla oblongata* (called *corpora striata*:) but from these tips, as from its rise, being expanded towards the hinder parts, it grows thinner by degrees, and towards its outer bordure its under side is knit to the *Caudex* or trunk

trunk of the *Medulla oblongata* by membranes and vessels.

Fornix.

Which membranes and vessels being cut in sunder, and the Brain turned up forwards as above directed, on its inner or under superficies there appears a medullar Process called *Fornix*, which springing forth of the *Corpus callosum* with a double root, is united into one broad Process near the place where the tips of the *Crua* of the *Medulla oblongata* adhere to the under-side or medullar part of the Brain, and serves as a Subtend to its Arch, (as was noted before.) Under the double root of the *Fornix* there lies a medullar Trunk, like a large Nerve, running cross the Brain and joyning one *Corpus striatum* to the other. And out of the middle superficies of the *Fornix* there stands up a thin and pellucid *Septum* or Partition, which is fasten'd to the roof or arch of the *Corpus callosum* almost through its whole Duct.

Septum.

This *Septum Columbus* affirms to be membranous, and *Malpighius* will have it to consist of streight Fibres running lengthways from before backwards. And thus while the three-sided *Fornix* doth subtend the Arch that arises from the complication of the Brain, it divides its Cavity as it were into three Partitions, and makes them look like so many *Ventricles*, by which name they have been described by former Anatomists.

Three Ventricles.

To these three *Ventricles* thus accidentally formed, the Ancients have attributed a noble Use: determining them to be the Work-house of the Animal Spirits, where they are both generated and perform the chief works of the Animal Function. *Fracassatus* (who calls the Brain a Wind-Instrument, somewhat analogous to the Lungs) thinks that a purer sort of Air ascends through

through the *Os cribriforme* into the two fore Ventricles, (where it is ethereized) and passes out of them into the third, and thence into the fourth (to be described in Chap. 7.) by which it is conveyed into the Spinal Marrow, where being mixed with the nervous juice, it therewith constitutes the Animal Spirit, and likewise promotes its motion. Where, and whereof the Animal Spirits are generated, we shall consider, Chap. 9. and shall here shew a more probable Use of these Ventricles. They have been commonly distinguished into *two anterior*, and *one posterior*. But the truth is, there is but one Cavity or *Vacuum*, and instead of that noble Use heretofore ascribed to it, late Anatomists make it only as a sink or common-sewer for excrementitious matter to be collected in, and to be discharged out of again by convenient ways. This excrementitious matter is generally a serous humour (or rather *lympha*) which is separated from the Blood in the adjacent *Plexus Choroïdes* by the help of those many Glands that that *Plexus* is beset withal, and of the *Glandula pinealis* which the *Plexus* hangs upon and is woven about like a button. As to the exit of this serous humour, formerly it has been supposed to flow from hence to the *Processus mammillares*, and from them to destill through the *Os cribriforme* into the Nose. But Dr. Lower denies any such office of the *Os cribriforme*, affirming that the holes in it are only for the transit of the Nerves and Membranes going forth from the *Processus*, and that these fill them so close that nothing can flow through them. And says, That the flux of Rheum through the Nose, and upon the *Uvula*, or into the Mouth, &c. in Catarrhs, falls not from the Head, but is separated from the Arteries in the Glands of the respective parts, as into the Nose through the Glands
of

of its investing Membrane, &c. And as to the ferrous matter that is poured into these *Sinus's* in the Brain, he says, it is all absorbed again by the Vessels gaping into them, and returns by the Jugular Veins to the Heart.

CHAP. VI.

Of the Medulla oblongata and its fore parts, viz. Crura, Corpora striata, Nervorum opticorum Thalami, Nates and Testes, with the Vulva and Anus; as also of the Glandula pinealis, Plexus choroides, and Infundibulum.

THE Brain continuing turned up forwards, and above-directed, the *Medulla oblongata* lies open to view, whose Parts, &c. we shall describe in this Chapter.

The Rise of the Medulla oblongata.

The *Medulla oblongata* seems to arise from the *Corpus callosum* by two Heads resembling the letter Y, and the united Trunk by and by descends out of the Skull down the Spine, wherein it is called the *spinal Marrow*, of which afterwards. *Fracassatus* questions whether the Brain, and the Cerebellum also be not rather appendices of, or propagated from the *Medulla spinalis* and *oblongata*, than these from those; seeing in the *Embryo* or first lineaments of a Chicken in the Egg, if you prick the *Carina* (or long thread that afterwards becomes the back) with a pin, it will contract itself, whilst in the Seat of the Brain there is nothing but a *Lympha* not yet fixed into a Brain. But this by the bye.

The Substance of the *Medulla oblongata* is not like that of the *Brain*, consisting of an outward or cortical part of an ashy colour, and of an inner medullar and white; but its whole is medullar; yet it is not pure and shining, but dusky from its many Fibres that hold a various course; for in some parts they are striated or radious as it were; in others direct, running lengthways, and in others circular.

Its two heads or beginnings are called its *Crura*, and the tips or extremities of these *Crura* are called *Prominentiæ lentiformes*, or otherwise *Corpora striata*, from the course that their Fibres keep. Their ends are blunt, and by a pretty large space of their surface adhere to the medullar substance of the *Brain* where it is thickest. If one cut them in sunder lengthways, then may be observe their *striae*, which have a double tendency; for some descend from their tip towards the *Medulla oblongata*, and others seem to ascend from their lower part towards the medullar part of the *Brain*, the one meeting the other. So that by the help of these Fibres there seems to be a free passage for the Animal Spirits from the *Brain* to the *Medulla oblongata*, or back again, as there is occasion. We observed above in the former Chapter, how there is a medullar process that running a-crofs joins one *Corpus striatum* to the other; and shall onely note here further, That just behind the lower end of these Bodies the *Processus mammillares* or smelling Nerves have their rise from the *Medulla oblongata*.

When these Nerves are arisen out of it, its *Crura* rise into uneven protuberances, out of which spring the Optick Nerves, and therefore these protuberances are called *Nervorum opticorum Thalami*; (what course both the Olfactory and Optick

its Sub-
stances

Crura and
Corpora
striata:

Thalami
nervorum
optico-
rum:

C c

Optick

Optick Nerves hold towards the Nose and Eyes, shall be shewn in *Ch. 10.*)

On the outside of these, Dr. *Ridley* sayes he has always found and often shewed a very fair medullary tract, running all along betwixt the *corpora striata*, and from the very hindermost extent of the *Corpora striata* forwardly, down to the very roots of the *Fornix*, to which they seem to be continuous.

Behind these *Thalami* the two *Crura* of the *medulla oblongata* unite into one trunk, upon whose upper side there grow four more notable protuberances, covering its surface for about the space of an inch, which yet they do not touch in the middle, having a cavity under them. There grow two on each side, the two formore of which are called *Nates*, and the two hinder *Testes*.

Nates and Testes. The *Nates* (or Buttocks) are the larger of the two, and the *Testes* seem onely to be an *Epiphys* or accretion to these. They are all four like many round hillocks, and are joined one to another by certain processes. Under them, or rather betwixt their junctures and the trunk of the *Medulla oblongata* that lies there-under, there is left a narrow but long cavity or chink, called by the fanciful name of *vulva*, into which there opens another passage called *anus*, and both run by a strait duct down into the *Infundibulum*. As to the Uses of the *Nates* and *Testes*, the learned Reader may do well to consult Dr. *Willis* largely discoursing thereof, in *Cerebr. Anat.* p. 93, but I shall not enter upon that Dispute, as being too conjectural and doubtfull.

Glandula pinealis. Betwixt the *Nates* and the *Thalami Nervorum opticorum*, in a valley as it were, is seated a Glandule, (of the conglobate or lymphatick kind called

called in Greek *κωνάειον*, in Latin *Pinealis*, from its shape, arising from a broad *Basis* to a narrower topped top, somewhat resembling a Pine-apple. It is fasten'd to the subjacent part, sometimes by many slender Fibres, and sometimes by two notable medullar Roots. Its Substance is harder than that of the Brain, and of a pale colour. It is included in a Membrane (which is a portion of the *Dura Mater*) as in a bag or case: which Membrane being full of Arteries and Veins, some of these enter into the Gland it self. This Gland *Des Cartes* thinks to be the primary seat of the Soul, and that all Animal Operations draw their Origin from it: But that seems to be too noble an Use for it; and it is more likely that it is onely of the nature of other Glands which are seated near the concourse of sanguiferous Vessels, namely that it may receive into it serous humours deposited from the Arterial Blood, and retain them till either the Veins becoming more empty resorb them, or Lympheducts (where there are any) convey them away.

That this is the true use of the *Glandula pinealis* ^{Plexus} is the more probable, from that notable *plexus* of *choroïdes* Blood-vessels that encompasses it, and hangs upon it as it were, called *plexus Choroïdes*, which is constituted after this manner. From each side of the *medulla oblongata*, where the *limbus* of the Brain is knit to it, there ascend in a streight course two Arteries arising from the hinder branches of the *Carotides* where they are joined to the Vertebral, which being by and by divided into very many small twigs, and being met by as many twigs of Veins coming from the fourth Ventricle of the *Dura Mater* (which descends upon the *glandula pinealis*) form this *plexus*, wherein both sorts of Vessels are very much interwoven one with

another, and which spreads it self on each hand, (as by two expanded wings) upon the *crura* of the *medulla oblongata* as far as to the *corpora striata*: yet these Vessels run almost onely upon the surface of the *medulla*, making no deep insertions either into it, or into the *corpus callosum* under which they are also spread. This *Plexus* is beset with very many small glands, which are all of them red, and almost spherical, only a little flattish.

Besides the Veins and Arteries that constitute this *plexus*, Dr. Ridley mentions a third sort of vessel, viz. *Lympheducts*, which he first discovered in the Brain of a strangled body, running in different ramifications amongst the reticulated vessels and glands of this part. "Which observation (sayes he) "being added to that of the great "Anatomist *Anthony Nuck*, (who in that curious "piece called *Adenographia*, sayes, he saw one "coming from the *glandula pinealis*, and that his "Friend, another Anatomist, sent him word "he saw another not far from the aforelaid "place,) may be of sufficient authority to evince "the real existence of these Vessels hitherto so "much enquired after, in the Brain, as well as in "other parts of the body.

its Use.

According to Dr. Willis, it has a double use: first, he says, that the more watry part of the Blood designed for the Brain, is sent into the vessels of this *Plexus*, that the remainder may be more sincere and defecate for the making of Animal Spirits: which watry part, if it be plentiful that it cannot be all received into the Veins, to be returned to the Heart, it is then received into the smaller glands wherewith the *Plexus* is beset, but especially by the *glandula pinealis* just now described, by which it is either re-
gained

tained; or if it abound, may destil from them into the subjacent cavity, as into a sink. (But there is no need of its either being retained in the Glands, or else of its destilling into the subjacent cavity, seeing the Lympheducts just now mentioned are proper reductory vessels for it.) A second office is, to preserve within the plicature of the Brain (or in the *corpus callosum*) an heat, which is raised from the Blood (as from a fire) that estuates in the complications of the vessels of the *Plexus*, and which causes the Animal Spirits to circulate in the *corpus callosum*.

Thus far as to the parts which appear on the upper side of the *medulla oblongata*, betwixt the *corpora striata* and cerebel. But within this space in the *basis* of the same *medulla* there are other things observable, especially the situation and structure of the *Infundibulum*. Now this *Infundibulum* is a tube-like receptacle, outwardly covered with a thin membrane arising from the *Pia Mater*, and within fenced with a medullar substance, which descends behind the coalition of the two Optick Nerves, betwixt the *crura* of the *medulla oblongata*: Its upper orifice is between the *crura*, and from thence a short tube or pipe descends upon the *glandula pituitaria*, (to be described in the next Chapter) upon which, serous humours (or *Lympha*) flow down from the upper cavities of the Brain this way; whence it has its name of *Infundibulum* or Tunnel. Which humours Dr. Ridley thinks to be condensed vapours arising from the Arteries of the *plexus Choroïdes*.

And thus we have done with the fore part of the *Medulla oblongata*, which only lies bare by the turning up of the Brain properly so called: In the next Chapter we shall examine its hinder

part, which comes to our view by raising up the *Cerebel* ; but of the *Cerebel* it self first.

C H A P. VII.

Of the Cerebellum, and the fourth Ventricle, as also of the hinder part of the Medulla oblongata, of the Rete mirabile and Glandula pituitaria.

BEfore we can take a view of the *hinder part of the medulla oblongata*, it is necessary to remove the *Cerebellum* that is placed upon it, (as the Brain is upon the *fore part*) which therefore we shall first of all describe.

The Cerebellum, its figure and substance.

The *Cerebellum* is seated in the *hinder part of the Head*, being of somewhat a globular figure as well as the Brain it self, and uneven in its surface (like it) by reason of certain convolutions, both the ridges and furrows where the *Pia Mater* is spread over, tying their summities together, covering their deep furrows, and reaching *Plexus* of vessels to them all. But its convolutions are not so various and uncertain as those of the Brain, but are disposed in a certain order like so many semi-circles; the *lamellæ* or plates lying upon and environing it in a parallel course. All these *lamellæ* have a cortical part and a medullar, which seem to be of like substance with the *cortex* and *corpus callosum* of the Brain, described before, Chap. 4.

its Processus vermiciformes.

Both regions of the *Cerebellum*, viz. the *fore and hinder*, terminate in a worm-like process, towards which the *lamellæ* or circles are shortest, length-

lengthning by degrees towards the middle or top.

The *Cerebellum* has a great many *plexus* of vessels beset with Glands, like the *plexus choroïdes* of the Brain, which come into sight by separating the *Pia Mater* from its hinder part; for there the *plexus* creep up on each side by the worm-like process, consisting on each side, of a branch from the vertebral artery, and of venous ducts sent out of each lateral *sinus* of the *Dura Mater*. To these *Plexus* and Glands Dr. Willis ascribes the same use as to those of the Brain, viz. that the Glands serve to separate the superfluous phlegm from the arterial Blood, and to retain it; and that both the Arteries and Veins not only running on the surface of the Cerebel, but sending twigs into its inner substance, the most subtile and spirituous part of the Blood being conveyed through long windings and serpentine ducts of vessels, and so sublimed into Spirit, is received and retained within, whilst the more impure and seculent part is sent back by the twigs of Veins that are also deeply inserted into the Cerebel.

It rests upon the trunk of the *medulla oblongata*, or rather seems to stand upon each side of it by two feet or stalks, betwixt which feet on the sides, the *cerebellum* above, and the *medulla oblongata* underneath, there is formed a cavity which is commonly called the *fourth Ventricle*, of which by and by.

In each of these feet that sustain the Cerebel, there are three distinct medullar processes; the first of which proceeding from the Nates, ascends obliquely; the second descending streight from the Cerebel, and passing across the former, encompasses the *medulla oblongata*; and the third descending from the hinder region of the Cere-

bel, is inserted into the *medulla oblongata*, encircling the thickness of its trunk.

*The annular
protuberance.*

The second of these Processes, *viz.* that which descends straight, is it which makes the *annular protuberance* (otherwise called *Pons Varolii*) upon the *medulla oblongata*, which it forms in this manner. Descending straight upon the *medulla*, as soon as it touches its sides, it seems not to be presently implanted into them, but growing into a greater bulk, encompasses the surface of the said *medulla* with divers circular Fibres. So that the Fibres of the Process of one side meeting those of the Process of the other side underneath, or at the *basis* of the *medulla*, make this circular protuberance. Which that it may be seen, as also the three Processes of each foot of the *Cerebellum*, &c. 'tis necessary to cut the Cerebel through the middle, from one Worm-like Process to the other, for then they will all appear plainly.

*The office of
the Cerebel.*

The office of the Cerebel has generally been reputed to be the same with that of the Brain, *viz.* to elaborate the Animal Spirits, which Anatomists have not used to distinguish into different kinds, till of late Dr. *Willis* has taught, that some Spirits assist *natural* motion, and others *spontaneous*. Accordingly he makes two Laboratories of these Spirits, appointing the Brain for the concoction of such Spirits as flow into those Nerves that perform *spontaneous* motions, *viz.* such which we are conscious of, and can moderate or determine, as the moving of the Hand, &c. and the Cerebel for the making of such as flow into those Nerves by which *involuntary* or natural motions are performed, *viz.* such as are done in a constant manner without our knowledge or will, as the pulse of the Heart, &c. To which opinion of his some have made these objections: *First*, That Fowl have no

Cerebel.

Cerebel, and yet their Heart, &c. moves. Secondly, The motion of the Heart, called natural, depending (in a great measure) on the influx of the Animal Spirits conveyed by the *par vagum* which arise out of the *medulla oblongata*, one cannot easily conceive how the Animal Spirits should flow into these Nerves from the Cerebel, and not as well those generated in the Brain; or if they entered them alone, why, Thirdly, not only the natural motion of the Heart should be performed by the said pair of Nerves, but voluntary motions also, as those of the *Larynx*, &c. He that would be satisfied of the grounds of Dr. Willis's Opinion, may consult his *Cerebr. Anat. capp. 15, 16, 17.*

We said a little above, that betwixt the two feet of the Cerebel standing on each side, and the Cerebel it self above, and the trunk of the *medulla oblongata* below, the fourth Ventricle was formed; which we need not further describe, only speak a word of its use; which some have thought to be, for the perfecting of the Animal Spirits (as they were prepared by the three other) and therefore they have called this the noble Ventricle. But as was said above of the other three, that they seemed not to be designed purposely by Nature, but resulted only accidentally from the conformation of the circumjacent parts, and served only as Sinks to receive serous humours separated in the Glands: so we believe that this results in like manner, and is of the same vile use.

Having now removed the Cerebel from off the trunk of the *Medulla oblongata*, we come to have a view of the hinder part of the *Medulla*. Now, omitting to speak of the *vertebral arteries* that run up by its sides, (as having mention'd them often before)

The fourth Ventricle.

The hinder part of Medulla oblongata.

Corpora
pyramida-
lia.

before) as also of the pairs of *Nerves* that arise out of it (which we shall describe afterwards) I shall only in this place take notice of the two medullar *pyramidal Bodies* adhering to its sides. These proceed from the *annular protuberance* formed about the *Medulla* by the second Processes of the feet of the Cerebel, near the *basis* of the *medulla*, and being distinct from the rest of the medullar trunk, they tend streight towards the *spinal Marrow*, and in their progress by little and little becoming narrower, after about the space of an inch, they end into sharp points pyramidal-wise, whence they have their name. Dr. *Willis* thinks them to be ducts or chanel's of the Animal Spirits from the annular protuberance, or, which is all one, from the Cerebel, to the *Nerves* that spring out of the *Medulla oblongata*, there whereabout these pyramidal bodies end.

We have now done with all the parts of the *Encephalos*, whether relating to the Brain, *Medulla oblongata*, or Cerebel, from whence we might proceed to the *action* of the Brain; but we will first describe the *Glandula pituitaria* seated in the cavity of the wedge-like Bone, with the notable *Plexus* of vessels spread about it in some creatures, called *Rete mirabile*; and in the next Chapter treat shortly of the *spinal marrow*, as being an appendix or continuation of the *Medulla oblongata*.

Glandula
pituitaria.

This *Glandula pituitaria* has a proper seat of its own made for it in the middle of the wedge-like Bone, in a cavity commonly called *Sella equina*. It is not so big in Men, as in many other Creatures, being hardly bigger than a large Pease. Its substance is far differing from that of other Glands: "In consistence indeed (as Dr. *Ridley* sayes) "'tis the same with most of the conglomate kind, if not somewhat harder; but then

“then being prest or squeezeed, it emits much
“more water than any of them. In its circum-
ference ’tis almost four-square, above somewhat
hollow, and below convex. It is covered with a
very thin Membrane from the *Pia Mater*, pro-
ceeding from the *Infundibulum*, and by means of
this Membrane it is knit very closely to the
Sella.

It has been heretofore a current opinion, that on *its Use.*
this gland is poured by the *Infundibulum* that se-
rious humour that is collected in the Ventricles of
the Brain above; and that from this Gland it des-
cends through the holes of the wedge-like Bone up-
on the Palate, so to be spit out by the Mouth. But
Dr. *Lower* denies this, appealing to the structure
of the parts, and his often experiments upon
Calves Heads: “In which, he says, the wedge-
“like Bone lying under the *Glandula pituitaria*, is
“sometimes perforated in divers places, at least
“by one large duct, which being divided into
“two, does on each side open into the Jugular
“Veins: so that if Milk or Ink be injected thro’
“those ducts by a Syringe, it presently passeth
“through on each side into the said Veins; and
“nothing of Tincture will appear about the Pa-
“late, Nostrils, Mouth, *Fauces* or *Larynx*. So
“that in a Calf the Humour that proceeds from
“the Brain, returns all again into the Veins.
“And the same thing he says he has lately tryed
“in a Man’s Skull, wherein though the wedge-
“like Bone be never perforated, yet Nature has
“framed other ducts, whereby all the *Serum* may
“be again derived out of the Ventricles of the
“Brain into the Blood: for there are two Ves-
“sels seated on each side the *Sella Turcica* (to be
“described Book VI. Chap. 6.) which with gaping
“Mouths

“ Mouths as it were receive all the Water deffil-
 “ led out of the *Glandula pituitaria*, and deposite
 “ it on each side into the Jugular Veins without
 “ the Skull; whose ducts will easily appear, if
 “ Water or Milk be squirted forcibly out of a
 “ Syringe into either Jugular Vein near the Skull,
 “ for the liquor will by and by break out near the
 “ *Glandula pituitaria*; which makes it evident,
 “ that whatever *Serum* is separated into the Ven-
 “ tricles of the Brain, and issues out of them thro’
 “ the *Infundibulum*, destils not upon the Palate,
 “ but is poured again into the Blood, and mixed
 “ with it.] So that according to this opinion,
 the Rheum that issues so plentifully sometimes in-
 to the Mouth and *Fauces*, &c. falls not from the
 Brain, but, as was noted above, is separated from
 the Arteries immediately by the Glands of the
 respective parts.

Rete mi-
 rabile.

In those creatures that have the *Glandula pitui-
 taria* large (as in Calves for instance) the two
 Carotid Arteries meeting about the *Sella* of the
 wedge-like Bone presently divide themselves in-
 to small twigs, which being interwoven with lines
 (though not so numerous) twigs from the internal
 Jugular Veins, and also with nervous Fibres from
 the larger trunk of the fifth pair of Nerves, make
 on each side a notable *Plexus*, called *Rete mirabile*.
 There enter into this *Rete* some twigs also from
 the Cervical Arteries; and there pass out of it
 several twigs into the *Glandula pituitaria*. So
 that in these Creatures that Gland seems to be of
 the same use to the *Rete mirabile*, as the *Glandula
 pinealis* is to the *Plexus choroïdes*, viz. to separate
 a serous matter from the arterial Blood. But in
 Man (according to most Anatomists) this *Rete*
 is wholly wanting; so that there passing only
 sometimes a twig or two, and sometimes none,
 from

from the trunk it self of the Carotid Artery into the *Glandula pituitaria*, that Gland is of less use in him than in other Creatures that have the *Rete*. Yet Dr. *Ridley* affirms, that he never found this *Rete* wanting, or with any difficulty discoverable in Men, springing from and lying on the inside of each Carotid Artery. But confesses that it is far smaller in them than in Brutes; for which difference he thus accounts. "Brutes by reason of their prone position, would, but for this *Rete*, be in danger of having their Brains deluged as it were with an over-great quantity of the influent Blood, and of a rupture of the vessels, by its violent ingress; and this danger so much the more threatned, by how much the same cause which brings it into the Brain with that force, is equally as great and effectual to hinder its proportionable return: For the relief of which inconveniency Nature hath contrived a means of its more easie and safe descent into the Brain, by turning that one large stream of Blood (which through its being pent in one chanel becomes so rapid) into many more, (by which means the Carotid trunk above the *Dura Mater* in those Creatures is very small to what it is beneath; whereas that Artery in Men, &c. hath the same bigness on both sides that membrane) and they not only reticulated and contorted for the more slow and laborious (which contrivance the Ancients thought was only for a more exact preparation of the blood for Animal Spirits) descent of the blood, but also many of them by their insertion into the *Glandula pituitaria*, attended with small Veins issuing thence, to take off some part of the burden too. . . . And that to the aforesaid position of several Creatures ought chiefly to be ascribed the variety of magnitude of this

"*Rete*"

“ *Rete* in several of them, its size in *Dogs* seems
 “ highly to evince ; in whom, by reason of their
 “ Horizontal position, being neither so prone as fe-
 “ veral Brutes who feed on grais, nor so erect as
 “ Man, this *Rete* is found smaller than in the first,
 “ and larger than in the last.

CHAP. VIII.

Of the Spinalis Medulla.

IT has been our method, whensoever we have come to the rise or origine of any part that is extended through several regions of the Body, to give a general description of it through its whole extent, as if it all belonged to that region where its rise is. Thus, for instance, we gave a general description of all the Arteries of both Head and Abdomen as well as of the *Thorax* in our Anatomy of the middle Venter, because they have all of them their rise from the *Aorta*, that springs out of the left Ventricle of the Heart seated in that Venter. In like manner having described the *Medulla oblongata* within the Skull, we shall prosecute it in its descent down the *vertebræ* of the Neck, Back, Loins and *Os sacrum*, wherein it is called the *spinal marrow* : But this very briefly.

Medulla
spinalis.

We shewed above how its head (the *medulla oblongata*) was joined by the *corpora striata* to the *corpus callosum* of the Brain, as also by those many protuberances that are upon it, both to the Brain and Cerebel, from and through which the Animal Spirits are derived into it. Its trunk within the Brain (after its *crura* are united) is generally about an hands breadth long : but its length

in the spine is very different according to the various statures of Men.

Its *Substance* is fibrous (which appears by the help of a Microscope) as if it were composed of ^{Its Substance.} innumerable slender long filaments, which whether they are hollow or no cannot be discovered through their fineness.

If one cut through its Substance, there will ^{Vessels.} innumerable little specks or sprinklings of Blood appear, but the Vessels are so small that they cannot be discovered. But there are plainly discoverable very many twigs of *Arteries* and *Veins* running through the Membranes that invest it (being principally branches of the *Cervical*) from which Arteries the Blood is infus'd into the pores of the *Medulla*, as it is imbib'd again from thence by the Veins.

It is round and long, and decreaseth not in its ^{Figure.} thickness by the Nerves that go out of it. But on the contrary (as Dr. *Willis* observes) " Where the most and the largest Nerves spring from it, it is there thickest, as particularly at the rise of the Brachial and Crural Nerves. Of which he gives this reason, " because within the medullar tracts the Animal Spirits do not run down and pass by swiftly, but for the most part issuing leisurely from their fountains, when they have filled all spaces, they keep their aboad in them; and where more spirits are wont upon occasion to be spent on any work, there are provided larger receptacles or store-houses for them.] Only towards its end in the *Os sacrum* it grows smaller and smaller.

It hath three *Membranes*. The first is that ^{Membranes.} which immediately cloaths it. This springeth from the *Pia Mater*, and passeth through its middle (dividing it into two parts) alone without the outer.

outer. The twigs of Arteries and Veins run mostly through this. The second covereth the first, and springeth from the *Dura Mater*. There is no distance between them, as there is in the Brain, but one toucheth another close, being knit together by Fibres. The third, proceeding from the Liganient which tieth together the fore parts of the *Vertebrae*, covereth both these.

Its division.

It is *divided* all along from the very first meeting of its *Crura* within the Skull, to the end of *Os sacrum*, by a membranous partition parting it into two; but this division is not apparent in the Spine, because of the *Dura Mater* that covers it, but it may be discovered if that be taken off, and the *medulla* severed in the middle. The partition is made of the *Pia Mater*, and by means of it it is that the use or motion of *one side* onely is sometimes taken away in the Palsie.

As for the *Nerves* that spring out of it, those shall be described after we have done with those of the Brain.

CHAP. IX.

Of the Action of the Brain, and the (supposed) Succus nutritius of the Nerves.

IT is generally agreed that the proper *Action* of the Brain (taken in a large sense) is the elaborating of Animal Spirits; and that they are sent from it by the Nerves into the several parts of the Body, for performing both natural and animal Actions. But what and of what nature these Animal Spirits are, and in what particular part

part of the Brain they are generated, is not agreed upon by learned Men.

Steno thinks it not improbable, that the Animal Spirits are of the same nature with the matter of light. *Dr. Ridley* calls them *fluidum Animale*, of which he thinks there is no reason to form any other Idea than what we ordinarily have of the purest liquors. And he looks upon this Animal fluid onely as a body consisting of very minute and flexile particles, contained in such a space as allowes them a capacity of being agitated on all sides by vertue of the subtil matter or ethereal *glebuli* they swim in, &c. *Dr. Willis* supposes they are spirituo-saline, and that in the Muscles they do effervesce with a latex of a contrary nature supplied by the Blood, whence the Muscle grows turgid, and consequently contracts. Some are of opinion that they differ in no other regard from the Vital, but only as they are conveyed by proper Vessels, and minister to other purposes, and are of a cooler temperament; but that there is no specifical difference betwixt them. Others on the other side think they differ in *specie*, and agree in nothing, but only that the Vital Spirits and Blood are the matter out of which the Animal Spirits are formed. Another sort deny the Arterial Blood to be the matter of these Spirits, and affirm that the Nerves of the Stomach, &c. absorb a part of the Chyle, of which they are made, and besides, Nutritious Juice, (of which by and by.) And some there are that suppose Air also to be an Ingredient, which either ascends into the Brain through the *Os cribriforme*, (and fills the Ventricles, according to *Fracassatus*) or insinuates it self into the Blood as that circulates through the Lungs. We cannot stand upon the examination

The Animal Spirits when, and of what made.

Anat. of the Brain. p. 108.

p. 155.

and refutation of several of these Opinions here; but upon a due consideration of the Arguments urged for each, we think that the Animal Spirits are specifically distinct from the Vital, but that the Vital, with the Arterial Blood, their Vehicle, are the true and onely matter, out of which they are elaborated.

Where elaborated.

And there is no less difference in what part of the Brain the Animal Spirits are made. Some deputing to that office the *Sinus* of the *Falx*, others the four Ventricles of the Brain, especially the fourth, a third sort the *Plexus choroides* and *Rete mirabile*; *Des Cartes* thinks, that they are separated out of the Arteries of *Plexus choroides* in the *Glandula pinealis* into the Ventricles; and others lastly assign the substance of the Brain and Cerebel (especially their cortical part) for the place of their confection. As to the *Sinus* of the *Falx*, the Use of that was shewn above, Chap. 3. And as to the Ventricles, seeing they are often almost quite full of waterish humour, but always have some, they seem very unfit for the making or storing up such subtile and volatile Spirits as the Animal are. As for the *Plexus choroides* and *Rete mirabile*, there is no Vessel that goes out of either which contains any thing but under the form of Blood; so that seeing there are no *Vasa deferentia* (or call them what you will) to convey the Spirits from these *Plexus* to the origin of the Nerves, we cannot reasonably ascribe to them such an Action. We must therefore subscribe to the last Opinion that ascribes this work to the very substance of the Brain and Cerebel, and is performed in this manner. The Heart is like the *Primum mobile* of the Body, to which the motion of all the humours, that have once past it, is owing. This by its *Systole* impells the Blood, as into all other parts.

parts, so into the Brain by the several branches of the *Carotides*, whose innumerable twigs run chiefly through the outer *Cortex* or greyish part of the Brain and *Cerebel*, and partly into the inner medullar or white substance. These twigs of Arteries spring partly from the *Plexus choroïdes*, and *Rete mirabile* (in those Creatures that have it) and partly from the *Carotides* themselves immediately. The superfluous *Serum* is separated from the Blood contained in the Arteries before they enter into the Brain and *Cerebel*, by the Glands above described; and that Blood which is not elaborated into Animal Spirits in these parts, is returned again to the Heart by the Veins. But those particles that are fit and proper to be converted into them, are extravasated into the very *Parenchyma* of the Brain and *Cerebel*, (*viz.* their Cortical Part) or at least are distributed through it by invisible Capillaries, in which being perfected into Spirits, these by help of the Fibres or Filaments which the inner medullar substance of the Brain and *Cerebel* chiefly consists of, are conveyed to the *Medulla oblongata* by the *Corpora striata* and other processes whereby the *medulla* adheres to the Brain and *Cerebel*; out of which *medulla* they enter the Nerves, whose inner substance is fibrous like the *medulla* from whence they spring. And the reason of this successive motion from one to another, is the Pulse of the Heart, whereby that which comes behind, always drives forward what is before. Whence the true cause of an Apoplexy (wherein motion and sense are almost quite abolisht) is very probably from the obstruction or compression, &c. of the Arteries in the Brain and *Cerebel*; whereby both little Blood and Vital Spirit can be conveyed thither to make Animal Spirit of, and also

when it is made, it is not impelled thence into the *medulla oblongata*, nor out of it into the Nerves, to enable them to perform their functions.

*The Succus
Nutritivus
of the
Nerves.*

There is no less controverſie about the *Nutritivus Juice* of the Nerves: ſome contending for it to that height, as to affirm that all the parts of the Body are *only* nourished by it, and not at all by the Blood, which by its rapid motion they ſay is liker to wear and carry away ſomething from the parts through which it paſſes, than to adhere to them for their reſtauration. Others are more moderate, and ſuppoſe that nourishment is diſpenſed *only* to the ſpermatick parts by the Nerves, which the Nerves receive not from the Blood, but imbibing the moſt thin part of the Chyle out of the Stomach and Guts, they carry it up to the Brain, from whence it is conveyed again by the ſame or other Nerves to the parts to be nourish'd by it. *Diemerbroeck* is of opinion, that the juice of the Nerves (which is as a Vehicle to the Spirits) being ſomewhat acid, does contribute or yield aſſiſtance to the nourishment of the ſpermatick parts, not as it is the matter of, but as it ſeparates from the Blood ſuch particles as are fit for, their nourishment. Whence it is, he ſays, that ſuch parts of the Body as are moſt exerciſed, and by conſequence into which moſt Animal Spirits flow, grow the ſtrongeſt, having more of ſuch particles of the Blood as are fit for their inſtauration, ſeparated in them. So they that are uſed to walk, will endure it better, than others that are not ſo uſed, tho' otherwiſe much ſtronger. And hence the right Arm is uſually ſtronger than the left, in thoſe that are right-handed (as we ſay.) But he thinks that the Nerves have no juice

juice in them which they did not first receive from the Blood. Dr. *Willis* is much of his Opinion, saying as to this last particular ; for he says, it is without doubt that the nervous Fibres and Filaments which cloath the sensory of the taste, and the Bowels that serve concoction, do immediately take some taste of the Aliments for the supply of the Brain, especially at such times as the Spirits are much wasted in too long fasting or over much exercise. But then that juice that may be supposed to be made thereof in the Brain, and to be dispensed by the Nerves into all the parts of the Body, he believes not to be the matter of the nourishment of any part whether spermatick or sanguineous : but that it is as the *form* onely, and the Blood the *matter*, whose several particles being analysed or severed by the said juice, are directed and adapted by its *directive faculty* or *plastic power*, as it were, to such parts respectively as they are suitable for. And from hence he draws a reason why paralytick parts do waste so much, though the Blood flow plentifully enough into them, *viz.* because the Nerves being obstructed, and no Animal Spirits (with their Vehicle) passing by them, the particles of the Blood are not separated for the supply of such parts.] As for the nervous juice, it must needs be very little in quantity, seeing if one make a Ligature upon the Nerve, it will not swell betwixt the Head and Ligature ; nor if one cut the Nerve in sunder, will any thing distil out of it. So that it seems very absurd to think that it should be sufficient for the nourishment of *all* the parts of the Body, according to the first opinion. Nor does it seem reasonable to imagine that the Chyle should ascend from the Stomach, &c. to the Brain by the Nerves, whiles this nervous juice that is contended for, with the

Animal Spirits, is descending by the same ; for one cannot conceive how such contrary motions of liquors in the same Vessel can be at the same time. Though from the sudden refection that persons ready to faint receive from spirituous liquors, &c. it be probable that certain *Effluvia* or subtil and spirituous vapours do enter the nervous filaments of the Mouth and Stomach, and recruit the Animal Spirits immediately, without fetching that compass that I believe all the Chyle does. And as the Nerves imbibe no Chyle from the Stomach, &c. so receive they no more from the Arteries, than some of its most spirituous and volatile particles elaborated in the Brain into Animal Spirits, which have indeed some little moisture accompanying them as a Vehicle, but which is neither of a suitable nature nor of proportionable quantity for the nourishment even of the spermatick parts only. For seeing the Nerves have no conspicuous Cavity, but only imperceptible Pores, by which any liquor can drill along them ; such liquor must needs be most thin and watery, and therefore unfit to be assimilated to any part. And lastly, as to the Opinion that it separates the particles of the Blood, and so distributes those that are respectively proper for, unto, each part, as the sulphureous to the fat, &c. or is to the Blood as the form is to the matter ; it is an ingenious Hypothesis I confess, but whether true, I dare not affirm. I shall only add what Dr. *Havers* sayes on this subject, viz. “I do not suppose that the *succus Nutritivus* of the Body is from the Nerves ; yet they have, as other parts, a supply of it for their own nourishment, which I take to be all the *succus Nutritivus* they have.”

C H A P. X.

*Of the Nerves arising from within the Skull ;
and first of the first and second Pairs.*

WE have now done with all the parts of the *Encephalos* wherein the Animal Spirits are either elaborated or stored up, and have also described the nature of the Spirits themselves : it remains, that we shew by what and how many Instruments they are dispensed to the parts for the performance of whose functions they are necessary. These Instruments are the *Nerves*, all of which spring either out of the *Medulla oblongata* within the Skull, or out of the *Medulla spinalis* in the Spine. They all of them arise by *Pairs*, so that they are not reckoned to be so many *Nerves*, but so many *Pairs* of Nerves. As for the *Pairs* within the Skull, they were formerly reckoned to be but *seven*, summ'd up in these Verses,

*Optica prima ; oculos movet altera ; tertia
gustat :
Quarta, & quinta audit ; vaga sexta ; at sep-
tima linguae est.*

But stricter Examination has found them to be more ; Dr. *Willis* particularly has encreased them to the number of *Ten*, holding the *Processus mammillares* to be the *olfactory* Nerves, and the *Par vagum* and *Intercostale* to be two distinct pairs : and lastly, describing a tenth pair, which descending out of the Skull with the *Medulla*, emerges betwixt the first and second *vertebrae* of the Neck. We shall adhere to this account, and de-

scribe the *Olfactory* and *Optick* in this Chapter, and the rest afterwards in order.

Nervi Olfactorii,
the first
pair.
Their rise.

Of all the *pairs* of Nerves that rise within the Skull, the *Olfactory* or smelling pair arise the foremost, and are therefore reckon'd for the first. They spring from the *Crura* of the *Medulla oblongata*, betwixt the *Corpora striata* and the little hillocks or eminences out of which the optick Nerves rise (called by *Galen* their *Thalami*.) Though *Diermerbroeck*, that (following the Ancients) denies them to be Nerves, affirms that they spring not from the said *Medulla*, but from the globous marrow of the Brain (properly so called) and its fore Ventricles.

Progress.

From their rise they run forwards under the *basis* of the Brain, (encreasing in bulk as they go) as far as to the *Os cribriforme* at the top of the Nose, growing there into round processes like Paps, being therefore called *Processus papillares* or *Mammillares*.

Cavity and Substance.

They are manifestly hollow in their whole progress, and their substance is very marrowy and soft.

Insertion.

Having arrived at the *Sinus* of the sieve-like Bone, they there acquire coats of the *Dura Mater*; with which being clad, *Dr. Willis* says, they are divided into many Fibres and Filaments, which pass out of the Skull through the holes in the said Bone into the caverns of the Nostrils, running through the Membrane that invests those caverns.

Use.

Dr. Willis ascribes a double *use* to them, making them both the true Organs of Smelling, and also Emunctories to the Brain, thinking that when too much *Serum* is collected in its Ventricles, these deriving it thence, send it forth by their filaments through the *Os cribriforme* into the Nostrils. *Diermerbroeck* believes they have only this latter use;

only

only that the *Serum* or *Lympha* distils from them as well upon the *Fauces* and their Glands, as into the Nostrils. Dr *Lower* grants only the former; and says, that "It is incredible that the humour that is contained in the cavity of these processes should issue out by the Nerves, (or *Nervous Filaments*) into the Nostrils, for if it did, the sense of Smelling must needs be much prejudic'd thereby. And besides, if this water could distil by and out of the Nerves, much more might the Spirits, that are thinner, and more subtil, fly away. And as to the humour contained in the cavity of the Processes, he supposes it to be of very great use; namely, that when *Effluvia*, or most subtil Particles exhaling from an external object, are delivered to the *Olfactory Nerves*, that their Species may reach the Brain the better, it was necessary that these Nerves or *Processes* should be made hollow from their very rise, and be filled with a limpid humour: Not that I believe, says he, that the Species themselves are conveyed through their cavities into the ventricles of the Brain, or that the Animal Spirits are lodged in those Ventricles, as the Ancients thought; but that they are therefore hollow and moisten'd within with water, that their marrowy Bodies may serve the better both for retaining and conveying Smells into the Brain: For as things smelled are better perceived from moist Bodies and in a moist Air, than in a dry season from the parched ground (as Huntsmen know too well) so it is likely that in the same manner as they are best perceived outwardly, they are also best conveyed inwardly, &c.] And indeed, if we will allow them to be Olfactory Nerves, (as I think there is great reason) it is very incongru-

ous that they should serve for an Emunctory to the Brain, to discharge its superfluous Serum. And therefore we think it fit to acquiesce in this Learned Physician's Opinion; and to believe that the *Lympha* or *Serum* gathered in the ventricles of the Brain, is emptied by those ways we before observed out of the same Author, and not at all by the nervous Filaments that pass from these Processes through the *Os cribriforme* into the Nostrils.

Nervi optici, the second pair. Their rise.

The second pair are the *Optici* or *Visorii Nervi*, which bestow upon the Eyes the faculty of seeing. They spring from the upper sides of those unequal protuberances of the *crura* of the *Medulla oblongata*, which are called *Nervorum opticorum tubercula*; from whence being carried forward, and somewhat downwards, after having fetcht a compass, they meet one another about the *Infundibulum*, upon the *sella* of *Os sphenoides*; where they are united by the closest conjunction, but not confusion, of their Fibres, which run parallel lengthways in these Nerves, as they do in all other.

Cavity.

They are obscurely hollow until they be united; but after, their hollowness cannot be discerned. This hollowness may be shewed in a large Beast newly killed, and in a clear light.

Thus do *Riolanus*, *Glisson*, &c. teach. But *Wesalius*, *Aquapend.* &c. deny that they have any manner of cavity. *Malpighius* says, "They have not one cavity only, but sundry; but that these cavities result only from the necessity of their structure, all their inner or medullar part consisting of round *Intestinula* or Fibres running lengthways, which cannot be so closely fitted to one another, but that there will result long Interstices,

De Cerebr.
p. 22.

Interstices, which yet perhaps are of no use, nor of the nature of Ducts, but only accidental. But whether the *Intestinula* or Filaments themselves have not little chanel's in them, (like to Blood-vessels) he thinks may be doubted of: But seeing sense has not yet discovered any such, 'tis probable that there are to be admitted only little Pores and Interstices in the medullar substance, by means whereof the nourishing and vivifying juice may be propagated.

After their union they are separated again, *Insertion.* and each of them running further forwards, passes through an hole of *Os cuneiforme*, and is inserted obliquely into the centre of the Eye of its own side.

Dr. Willis says, they receive not only nervous *Vessels.* fibres from the third pair of Nerves, but also twigs of Arteries from the fore-branches of the *Carotides*, which run upon them as far as the *base* of the Eye. Whence, he thinks, a Reason may be assign'd, why, when a man grows sleepy after plentiful eating or drinking, he presently feels a notable heaviness or oppression as it were about his Eyes. For when the Blood becoming very turgid fills the vessels that run through the Brain, more than usual, and by distending them stops the pores of the Brain; these Nerves also in their whole course are compressed by the Blood that is become turgid in their Blood-vessels likewise.

Dr. Ridley says, that he has seen the blood-vessels to run not only upon or with them, but also in injected bodies exactly quite through the medullary substance of them, into the reticular coat of the Eye, wherein they end in an infinite number of the most capillary ramifications, which by an injection of that Artery, made with Mercury,

cury, becomes very delightfully conspicuous to the Eye.

*Substance
and parts.*

They are very soft, so long as they are within the Skull, but having pass'd the *Os sphenoides*, they become somewhat more firm and hard. The reason of which alteration seems to be, that within the Skull they are only clad with the *Pia Mater*, but as they go out, they assume a second coat from the *Dura Mater*.

*They make
the proper
tunics of
the Eyes.*

From the whole substance of these Nerves, viz. from their two Membranes and the inner medullar and fibrous substance, are the three (proper) Tunics of the Eyes framed; for the *Cornea* or *Sclerotica* doth proceed from the *Dura Mater*, the *Choroïdes* or *Uvea* from the *Pia Mater*, and the *Retina* from the marrowy substance.

C H A P. XI.

Of the third, and fourth Pairs.

*The third
pair.
Their be-
ginning.*

THE *third Pair* are termed *Motorii Oculorum*, because they move the Muscles of the Eyes. They have their beginning at the innermost part or *basis* of the trunk of the *Medulla oblongata* behind the *Infundibulum*.

*Why both
the Eyes
are directed
to the same
object.*

This pair is united at its rise; whence is commonly drawn a reason why one Eye being moved towards any object, the other is directed also to the same. But though this conjunction may be a reason why the Spirits should flow equally to the Muscles of each Eye; yet it satisfies not why they should flow at the same time, into different Muscles. As for example; Why, when one would look to the right side, the Spirits are presently

presently determin'd into the *external muscle* of the right eye, and into the *internal* of the left; and not into the external, or internal of both. And therefore a truer reason of both Eyes being moved together to one object, is the intention of the mind, which aiming only to have a view of one object at one time, directs the spirits to those Muscles only that serve to turn the Eye towards that object, &c.

They are smaller and harder than the former, *Their substance and branches.* and presently parting one from the other, they pass along by the optick pair, and penetrating the second hole of *Os cuneiforme*, are carried towards the globe of the Eye, where each is divided into four branches. The first whereof mounting above the Optick, is bestowed upon the attollent Muscle, and the Eye-lid. The second is inserted into the adducent Muscle by sundry small twigs. The third by many Fibres is inserted into the depressant Muscle. The fourth passing further in a single trunk, is implanted into the middle of that Muscle that draws about the Eye obliquely downwards to the inner corner. At that place where this Nerve divides it self into four branches, it forms a little round *Plexus*, out of which many slender twigs arise that creep through the trunk of the Optick Nerve, serving perhaps to widen or straiten it as there is occasion.

The fourth Pair proceed from the top of the *Medulla oblongata*, (contrary to all others, which arise either from its *basis*, or *sides*) behind the round protuberances called *Nates* and *Testes*: whence bending forwards by the sides of the *Medulla oblongata*, they presently hide themselves under the *Dura Mater*; under which proceeding a while, they pass out of the Skull each in a single

The fourth pair. Their beginning, march and insertion.

gle trunk at the same hole with the others designed for the Eyes, (communicating with no other Nerves in their whole progress) and are bestowed wholly (as Dr. *Willis* affirms) on that Muscle of the Eye called *Trochlearis*, which serves to rowl the Eye about. Which motion of the Eye being generally attendant upon or expressive of some passion of the Mind, as Love, &c. these Nerves are thence called *Oculorum pathetici*.

C H A P. XII.

Of the fifth, sixth, and seventh Pairs.

*The fifth
pair.
Their rise.*

TH E *fifth pair* spring from the sides of the *Medulla oblongata* where it is encompassed with the annular process or protuberance of the Cerebel, (or, as Dr. *Willis* will have it, from that process it self.) Each trunk is very large and broad, consisting of very many Fibres, some soft, and some hard: So that it seems to be not one single Nerve, but a collection or bundle of many small ones, some of which are designed for one part, some for another; some serving for motion, and others for sense. And the reason why they are all united together in their rise, the said Author thinks to be, that there may be a sympathy and consent of actions in the several parts to which they are distributed. Whence it is that seeing or smelling what is pleasing to the Appetite makes ones Mouth water, &c. because this pair of Nerves sends twigs both to the Eyes, Nostrils, Palate, and Tongue, &c.

*Division
and pro-
gress.*

Each trunk is divided into *two* notable branches, sometimes before, but oftener after it has penetrated

trated the *Dura Mater*. The *first* whereof tending streight downwards, and passing out of the Skull by its proper hole, in its descent towards the lower Jaw (for whose parts 'tis chiefly design'd) is divided into many lesser Branches, which provide for the temporal Muscle, as also for the Muscles of the face and cheeks. From these also there go twigs to the Lips, Gums, roots of the Teeth, *Fauces*, Tonsils, Palate and Tongue. The *second* Branch of this fifth pair, being the larger, goes a little streight forward by the sides of the *Sella Turcica*, and over against the *Glandula pituitaria* sends little twigs to the trunk of the *Carotides*, or to the *Rete mirabile* in such creatures as have it: then inosculates with the Nerve of the sixth pair, and afterwards sends back a slip or two, which being united with another slip returned from the Nerve of the sixth pair, constitute the root or first trunk of the *Intercostal pair*, which we shall reckon for the ninth, and speak of it by and by. After this it is divided into *two* notable branches: The *left* and *upper* whereof tends towards the globe of the Eye, and being again divided sends forth two other, the first of which is parted into two more, that go one to the Nose, and the other to that Muscle of the Eye which is proper to Brutes; and the second into four or five slips, that are mostly spent on the Eye-lids, but partly on the *Uvea tunica* and the Glands of the Eye. The *greater branch* (of its second division) being carried towards the orbit of the Eye, is divided into two new branches. The *lower* whereof bending downwards, is bestowed on the Palate and upper region of the *Fauces*; and the *upper* being carried beyond the orbit of the Eye, passes through a hole of the upper Jaw,

Jaw, with the Vein and Artery which it twists about, and sends many slips to the Muscles of the Cheeks, Lips, Nose, and roots of the upper Teeth. From its twisting about the sanguiferous Vessels designed for the Cheeks, and other parts of the Face, may a reason be drawn why one blushes when he's asham'd : for the Animal Spirits being disturbed by the imagination of some uncomely thing, as if they took care to hide the Face, enter this Nerve disorderly ; so that its twigs embracing these sanguiferous Vessels, by compressing and pulling of them cause the Blood to flow too impetuously into the Cheeks and Face by the Arteries, and detain it there some time by constringing the Veins.

*The sixth
pair.
Their rise
and inser-
tion.*

The *sixth* pair rise just by (but below) the fifth, and each presently sinking under the *Dura Mater*, goes out of the Skull by the same hole with the Nerves of the third and fourth pairs, and is carried by a single trunk towards the orbit of the Eye ; but so, as by the side of the *Sella Turcica* it inosculates with the second or greater branch of the fifth pair, (as was noted in the former Paragraph :) whence sending back sometimes one, sometimes two twigs, these being united with the recurring twigs of the fifth pair (above-mentioned) make the beginning of the *Intercostal Nerve*. Afterwards going forwards, near the orbit of the Eye it is divided into two Branches ; of which *one* is inserted into the abducent Muscle of the Eye placed in its outer corner ; and the *other* being cleft into many Fibres, is bestowed on the seventh Muscle proper to Brutes, whereby they defend the Eye from external Injuries accidentally occurring, when they are said *nictitare* (which I think we have no word to express in English.)

The *seventh* pair, by the Ancients commonly reckon'd for the fifth, minister to the sense of ^{The seventh pair.} Hearing. Each Nerve has two Processes, one soft, ^{Their rise and insertion.} and the other harder, which might seem to be two distinct Nerves, but they are usually accounted for one. They spring a little behind the former, out of the sides of the *Medulla oblongata*. Dr. *Willis* says, the *softer* process arises from the lower side of the annular protuberance, from whence it ascends; and the harder from its upper part, from whence descending it meets the other. The *soft* part or process (that is properly the auditory Nerve) is carried through an hole of *Os petrosum* into the cavern of the Ear, which it cloaths with a most thin Membrane. By this are sounds conveyed to the common Sensory. The *harder* process serves rather for motion than sense; which passing out also through the *Os petrosum*, by its proper hole, presently admits a twig from the *Par vagum* or eighth pair, after which it is immediately divided into *two* branches; one whereof tending downwards, is bestowed on the Muscles of the Tongue and *Os hyoides*; and the other winding about the auditory passage, and tending upwards, is divided into three twigs; of which the *first* corresponding to the Nerve of the first division, bestows certain slips on the Muscles of the Lips, Mouth, Face and Nose, and so situates some outward organs of the Voice, as the former some of the inner; the *second* is distributed to the Muscles of the Eye-lids and Fore-head, and the *third* to the Muscles of the Ears. Whence upon some unusual and astonishing sound, by a certain natural instinct, the Ears prick up, and the Eyes open. As also the voice does officiously answer as an Echo to those sounds that are perceived by the Ears, from the community of

E e

the

the Nerves distributed to the organs of the voice and Hearing.

C H A P. XIII.

Of the eighth, ninth, and tenth Pairs.

The eighth pair.

THE next *Pair* in order is the *eighth*, which has used to be reckon'd for the sixth, and is otherwise called *par vagum*, or the *wandering pair*, from their being distributed to sundry parts.

Their rise.

They spring below the auditory Nerves, out of the sides of the *Medulla oblongata*, the root of each Nerve consisting of twelve Fibres at least (in Man) to which a notable Fibre, or rather Nerve (much greater than any of these twelve) coming from the spinal Marrow as far as from about the sixth or seventh *vertebra* of the Neck, is joyned, and both are invested with the same Coat from the *Dura Mater*, as if they grew into one Nerve; but if their common Coat be removed, this accessory Nerve, and many of the other Fibres remain still distinct, and after they are gone out of the Skull together, are dispensed to several parts; the accessory Nerve to the Muscles of the Neck and Shoulder-blade; and one notable Fibre of the eighth pair to the harder process of the Auditory or seventh pair, as also two others to the Muscles of the Gullet and Neck. But the other Fibres of this *par vagum* continue united, and instead of those companions they have parted with, each Nerve entertains a new one, namely a branch from the *Intercostal* or *ninth* pair, whereby is made a notable *Plexus* (which in a Nerve is like the joint of a Cane, or the Knot upon

upon the Trunk of a Tree where a Bough goes out, whence they are called *ganglioformes*) and out of the same *Plexus* there springs a considerable branch, which being carried towards the *Larynx* is divided into three twigs, of which one goes to the sphincter of the Gullet, a second to the upper Muscles of the *Larynx*, and the third going under the *Cartilago scutiformis*, meets the top of the recurring Nerve and is united to it. Below the afore said *Plexus* of this *par vagum*, each *Progreſs*: trunk goes ſtreight down by the ſides of the aſcending *Carotides*, on which they beſtow ſome ſlips. And at the bottom of the Neck each receives a ſecond branch from the Intercoſtal, (*viz.* from its firſt *Plexus*) and near thereto the left Nerve of this pair ſends out another twig into the recurring Nerve, but ſo does not the right. From hence both trunks deſcend without any notable ramification, till they become over againſt the firſt or ſecond Rib; where out of a ſecond *Plexus* (or knot) many Twigs and Fibres go towards the Heart and its appendage, from whence this *Plexus* is called *Cardiacus*. There is one notable difference (which we cannot but note) of the two recurring Nerves that ſpring out of the trunks of this eighth pair, *viz.* That that on the right ſide ariſes out of it higher, and windes about the Axillar Artery; whereas that on the left ſprings much lower therefrom, and twiſting about the deſcending trunk of the *Aorta* returns back from thence. Dr. *Willis* ſays that the recurring Nerve is really a diſtinct Nerve from the *Par vagum* from the very Original, and was onely included in the ſame caſe or cover for the more convenient and ſafe paſſage. The branches of the *Par vagum* do frequently unite with others of the Intercoſtal pair about the *Præcordia*. And when

their two Trunks are descended as low as over against the Heart, many twigs go out of them into the Lungs, &c. Whence both trunks descending by the sides of the Gullet are divided into two branches, *outer* and *inner*: The *outer* unite with the *outer*, and the *inner* with the *inner*, and both descend to the Stomach, in which they terminate, but are spent chiefly upon its upper orifice. As for their more particular distribution, we have spoken thereof while we treated of the parts themselves on which they are bestowed.

End.

The ninth
Pair.

We are next to describe the *ninth pair* (which before Dr. Willis was not distinguished from that going before.) It is called the *Intercostal*, because as its Trunks march down by the roots of the Ribs, betwixt every Rib they receive a branch from the spinal pairs. They have no proper root of their own, but each trunk is compounded of two or three recurring branches of the fifth and sixth pairs, (near their origine) as was noted when we treated of those pairs. Being thus formed they pass out of the Skull by their proper holes, and presently each has a *Plexus* near those of the *Par vagum*, into which, two nervous processes from the tenth pair of the Brain are inserted, and out of which there goes a twig into the sphincter of the Gullet, and into the *Plexus* (afore said) of the *Par vagum*. Whence descending by the vertebra of the Neck, by that time they arrive at its middle, each has another greater *Plexus*, into which a large Nerve from a neighbouring vertebral pair is inserted; and from which proceed many twigs that uniting with others of the *Par vagum* are distributed all about the *Præcordia*, and also one single one a little lower. This *Plexus* is called the *cervicalis*.

Their Rise.

Progress.

cervicalis out of which so many branches spring, is proper to Man, being not found in Brutes. From the Neck they descend by the *Claviculae* into the *Thorax*, where having arrived at the second Rib, each receives three or four branches from the vertebral Nerves next above, whereby is made another notable *Plexus* (commonly called the *Intercostal*.) From whence as they pass down by the roots of the Ribs, in every one of their Interstices and even as low as *Os sacrum*, from every jointing of the *vertebrae* each receives a vertebral branch. Alſoon as they are descended out of the cavity of the Breast, and are come over against the Stomach, each sends forth a notable branch, which tending towards the Mesentery, make its chief *Plexus*, which are in number seven, five large ones which are upper, and two less that are lower. For each branch is presently divided into two other, and every one forms one *Plexus*, which make four; and the fifth is in the middle of these, being the largest, and like the Sun amongst the Planets (as Dr. *Willis* compares it.) And these are the five upper. The two lower are framed of branches that spring from the trunks descended as far as the lower part of the Loins, and are distinguished by the names of *Plexus Infimus*, and *Minimus*. As to the parts that all the twigs which spring from these seven *Plexus* are distributed to, it may be learned from the description of the parts themselves in the *First Book*, in which we constantly mentioned from whence each part had its Nerves. Lastly, when this Intercostal pair is come to the *Os sacrum*, its two Trunks bend toward each other, and seem to be knit together by two or three Processes, and at length each of them ends in small Fibres that are distributed into the Sphincter of the

End.

The tenth
Pair.
Their Rise
and Pro-
gress.

We are now come to the *tenth* and last pair of Nerves that rise from the *medulla* within the Skull. This pair spring from the sides of the *medulla*, behind all the rest, and descending with it out of the Skull into the *vertebræ* of the Neck, they come out betwixt the first and second *vertebræ* thereof. Presently after their egress each sends forth a branch into the *Plexus* of the Intercostal Nerve of its own side: but their main trunks being carried downwards, and each receiving a twig from the ninth pair, they are bestowed on the Muscle *sternothyreoideus*, and some other Muscles of the Neck. So that though this pair rise within the Skull, yet it seems to be more of the nature of the Vertebral Nerves, as bestowing some branches on the Intercostal, and being all the rest of it spent upon the Muscles of the Neck.

And thus we have done with all the Nerves that proceed from the *Medulla* within the Brain, in describing of which we have followed Dr. *Willis* for the most part, that most accurate Tracer of them.

Tab. XV.

Fig. I. Representeth the outer or upper superficies of the Brain taken out of the Skull; where the *Limbus* of the Brain being loosed from its coherence with other parts by Membranes, is lifted up and bent forwards, that the *Cruna* of the *Medulla oblongata*, the *Fornix*, *Nates* and *Testes* with the *Glandula pinealis*, and other processes may be clearly and distinctly seen, (from Dr. *Willis*.)

AA The *Limbus* of the Brain, which in its natural Situation was contiguous to the Cerebellum.

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Fig. I.

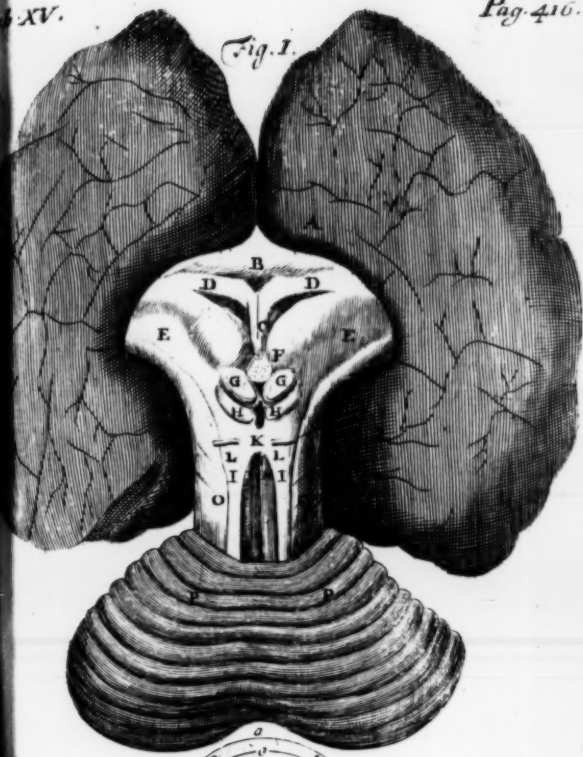
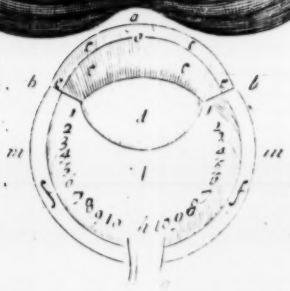


Fig. 2.





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- B *The Bordure or Margent of the Corpus callosum spread over both Hemispheres of the Brain, which in its natural Situation lay upon the Glandula pinealis.*
- C *The Fornix.*
- DD *Its Arms embracing the Crura of the Medulla oblongata.*
- EE *The Crura of the Medulla oblongata, (out of which the optick Nerves proceed) whose Ends (being placed further out of sight) are called Corpora striata.*
- F *The Glandula pinealis, betwixt which and the root of the Fornix is the chink that leads to the Infundibulum.*
- GG *The orbicular Protuberances called Nates.*
- HH *The lesser Protuberances called Testes, which are Processes of the former.*
- II *The Medullary Processes, which ascend obliquely from the Testes to the Cerebellum, and make a part of each of its Meditullia.*
- K *The joining of those Processes by another transverse Process.*
- L *The Rise of the pathetick Nerves (or fourth pair) out of the joining of the aforesaid Processes.*
- MM *A portion of the Medulla oblongata lying under the aforesaid Processes and Protuberances.*
- N *The Foramen of the Ventricle or Cavity that lies under the orbicular Protuberances.*
- OO *A portion of the annular Protuberance let down from the Cerebellum and embracing the Medulla oblongata.*
- PP *The outer and upper Superficies of the Cerebellum.*

Figure II.

Representeth the Eye cleft in two (from behind forwards) that the divers Situation of the humours may appear, (from Dr. Briggs.)

E e 4

h a b The

- b a b *The Tunica cornea, or fore and more convex arch of the Eye.*
 ee *The Tunica uvea (whose Foramen o is called the Pupilla) swimming in the watry humour cccc.*
 d *The Crystalline humour in situ.*
 f f *The Tunica choroides, which in this Figure (as being too much separated from the Sclerotica mm) cannot be duly represented.*
 g *A portion of the Optick Nerve.*
 h *Some of its small Fibres cut off near the exit of the Nerve.*
 I *The Centre of the Humor Vitreus, and of the Retina.*
 i, 2, 3, 4, 5, &c. *The Capillamenta of the Optick Nerve, whose ends on each side being cut off did adhere to the Ligamentum ciliare (namely by the Region of the Crystalline humour.)*

Tab. XVI.

Fig. I. Representeth the Basis of an Humane Brain taken out of the Skull, with the Roots of the Vessels cut off short, (from Dr. Willis.)

- AAAA *The fore and hinder Lobes of the Brain.*
 BB *The Cerebellum.*
 CC *The Medulla oblongata.*
 DD *The Olfactory Nerves, or first Pair.*
 EE *The Optick Nerves, or second Pair.*
 FF *The Motory Nerves of the Eyes, or third Pair.*
 GG *The Pathetick Nerves of the Eyes, or fourth Pair.*
 HH *The fifth Pair.*
 II *The sixth Pair.*

KK kk *The*

Fig. I.

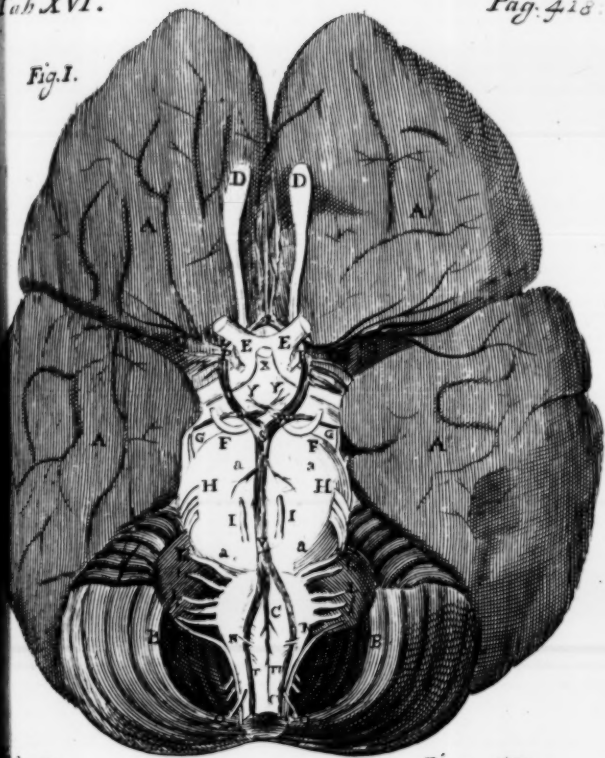


Fig. 5.



Fig. 3.

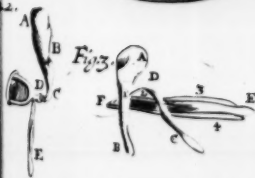
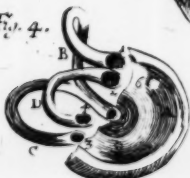


Fig. 4.





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- KK *kk The Auditory Nerves, and their two Processes on each side, the seventh Pair.*
- LL *ll, &c. The Par vagum or eighth Pair, consisting of several Fibres.*
- MM *The Spinal Nerve coming from afar to the Origin of the Par vagum.*
- NN *The ninth or Intercostal Pair, consisting also of many Fibres (that tending downwards, unite into one Trunk) which emerges a little above the Process of the Occiput.*
- OO *The tenth Pair tending downwards.*
- PP *The Trunk of the Carotid Artery cut off, where it is divided into the fore and hinder Branch.*
- QQ *Its Branch passing betwixt the two Lobes of the Brain.*
- R *The fore Branches of the Carotides, being united, part again, and proceed to the Fissure of the Brain.*
- S *The hinder Branches of the Carotides united, and meeting the Vertebral Trunk.*
- TTT *The Vertebral Arteries, and their three ascending Branches.*
- U *The Branches of the Vertebral Arteries uniting into the same Trunk.*
- WW *The place where the Vertebral and Carotid Arteries are united, and a Branch on either side ascends to the Plexus choroides.*
- X *The Infundibulum.*
- YY *Two Glands placed behind the Infundibulum.*
- aaaa *The annular Protuberance, which proceeding from the Cerebellum embraces the Trunk of the Medulla oblongata,*

Fig. II. Exhibits a side-view of the Anvil and Stirrup (two bones in the first cavity of the Ear) *in situ*, from *Monf. du Verney*.

- A *The thick part of the Anvil.*
- B *The short Branch which in this situation we behold fore-right.*
- C *The long Branch.*
- D *The Head of the stirrup which is joined with the long Branch, the fourth little bone coming between.*
- E *The Muscle that is inserted into the Head of the Stirrup.*

Fig. III. Represents the Hammer (a third Bone in the same cavity) on its fore-side with its Muscles *in situ* , from the same Author.

- A *The Head of the Hammer.*
 - B *The Handle.*
 - C *The external Muscle of the Hammer.*
 - D *Its Insertion.*
 - E *The internal Muscle.*
 - F *The place where it is fitted for its Insertion into the Handle of the Hammer underneath the external Muscle.*
1. *The great Process of the Hammer in a direct View.*
 2. *The slender Process into which the external Muscle is inserted.*
 3. 4. *The nervous Covering of the internal Muscle opened in the middle, that the Muscle may be seen.*

Fig. IV. Shews a portion of the Vestibulum or entrance of the Labyrinth (a second cavity of the Ear) with its three semicircular Canals from the same Author.

- A *The lower part of the Vestibulum.*
- B *The upper Canal.*
- C *The lower.*

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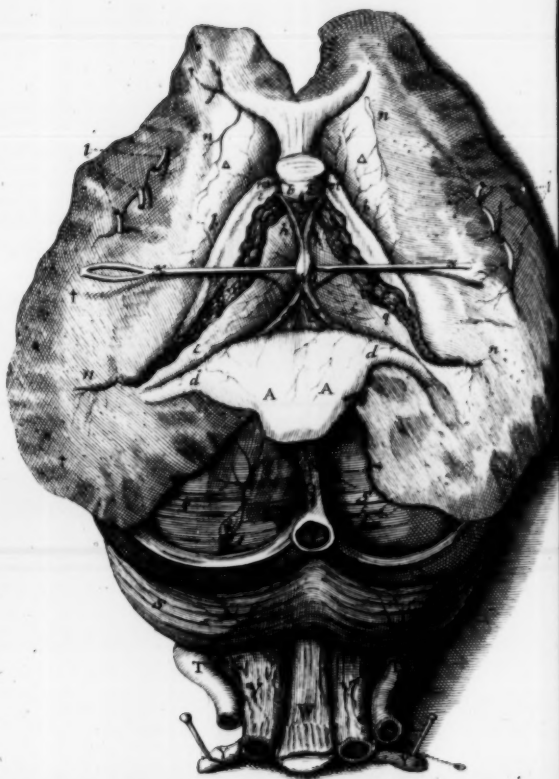
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D The middle.

1. The entrance of the upper semicircular Canal.
2. The first entrance of the middle Canal.
3. The entrance of the lower Canal.
4. The other entrance of the middle Canal.
5. The common entrance to the upper and lower Canals.
6. The first Hole that gives a passage to one of the Branches of the soft part of the auditory Nerve.
7. The second Hole that gives a passage to another Branch of the same Nerve.

Fig. V. Shews the *Cocblea*, which the foresaid Author makes a part of the Labyrinth, but other Anatomists call a third Cavity.

Tab. XVII.

Representeth the Brain in a middle section, the Blood-vessels being first injected with wax, (from Dr. Ridley.)

AA The Fornix cut off at its roots and turned back.
b Its roots at the beginning of the Thalami Nervorum opticorum.

c &c. The Thalami Nervorum opticorum.

d That part of the crura Fornicis which growing somewhat thicker as it turns off towards the Lateral Ventricles, runs over the crura Medullæ oblongatæ, which being very prominent in Sheep and Calves, help to thrust it up into such a protuberance as the Ancients called Bombyces or Hippocampi.

e That part of the Plexus Chorooides which is made of the first branch of the Cervical Artery, sometimes seeming as though it came from the communicant branch in the lateral Ventricles.

f The

- f *The place where those two Plexus's on each side meet under the Fornix.*
- g g *That other part of the Plexus which is made of the second branch of the Cervical Artery joined with the first by a communicant branch not to be seen here, lying under the crura Fornicis, which is expanded all over the Isthmus, becoming glandulous near to, and especially under the Glandula pinealis covered here with the Fornix.*
- h h *Two large Veins coming from the top of the upper part of the Plexus down to the other branch of the Plexus, all the length of the third Ventricle, and then terminates in the fourth Sinus.*
- i i *The trunks of several Arteries appearing as they were cut off in dividing the medullary † and cineritious * part of the Brain.*
- k k *A venous branch on each side entring the Plexus Choroeides, from whence there are many slip branched upon the corpora striata.*
- Δ Δ *The corpora striata whole.*
- l *The rima of the third Ventricle.*
- m m *A long medullary tract between the Thalami Nervorum opticorum and corpora striata.*
- n n, &c. *The Centrum ovale of Vieussenius.*
- O *The fourth Sinus of the dura mater.*
- P *The Torcular where the Sinus's meet.*
- Q Q *The lateral Sinus's.*
- R *A large Vein entring the lateral Sinus on one side.*
- S S, &c. *The Cerebellum covered with the second process of the dura mater on its uppermost part.*
- T T *The vertebral Arteries.*
- V V *The Vertebral Sinus's.*
- W *The Medulla Spinalis with its integuments.*
- X X *The style supporting the large Veins of the Plexus Choroeides in the third Ventricle.*
- q q *The Lympheducts of the Plexus Choroeides.*
- Y Y *Two of the Cervical Nerves springing from the Medulla oblongata, † †*

† † *The medullary part of the Brain.*

* * *The cineritious part of the Brain.*

C H A P. XIV.

Of the Nerves of the Spinalis Medulla ; and first of the Nerves of the Neck.

WE observed above, that when the *Medulla oblongata* is descended out of the Skull into the Spine, it loses its name of *Oblongata*, and acquires that of *Spinalis*, (which name it borrows from the *Spine* through which it passes) but is of the same fibrous or filamentous substance as it was within the Brain. And now we come to describe the Nerves that spring out of it, which assist the motion of all those parts, which those ten pair already described, that arise within the Skull, reach not to.

In its whole progress from the Skull to the *Coccyx*, there spring out of it *thirty* pair of Nerves : *seven* of which are of the Neck, *twelve* of the *Thorax*, *five* of the Loins, and *six* of *Os sacrum*.

The *first* and *second* pairs of the Neck come not out of the sides of the *Vertebrae*, as all the rest do ; but because of the peculiar articulation of the two uppermost *vertebrae*, spring out before and behind.

The *fore* Nerve of the *first* pair cometh out between the bone of the *Occiput* and the first *vertebra* of the Neck, and is bestowed upon the Muscles of the Neck which lie under or behind the *Oesophagus*, and on the Skin of the Face. The *under* Nerve cometh out of the hole which is

*Nerves
Springing
from the
Spinalis
medulla.*

*Seven of
the Neck.
The first
pair.*

com-

common to the *Os occipitis* and the first *vertebra* of the Neck. This hath two twigs: The smaller is bestowed upon those Muscles which lie upon the *Occiput*, and upon the skin of the Head as high as the Crown; the bigger is inserted into the Muscle which lifteth up the Shoulder-blade.

The second. The fore Nerve of the second pair (which is smaller) cometh out between the first and second *Vertebra*, and is bestowed upon the Skin of the Face. The hinder cometh out of the sides of the hinder process of the second *Vertebra*, but presently is parted into two twigs. The thicker of which is bestowed upon the whole Skin of the Head even to the Crown; The smaller upon the greater streight, and the lower oblique Muscles which stretch out the Head. Dr. Willis says, that the first and greatest root of the Nerve of the *Diaphragm* ariseth from the second pair of the Neck: of which Nerve we shall speak more by and by.

The five remaining pairs of the Neck, as also all the pairs of the Back and Loins, and the first of *Os sacrum*, come out of the lateral holes betwixt the *Vertebra*, and immediately after their exit are divided into the fore and hinder branches and are distributed as followeth.

The third. The third pair come out of the lateral hole between the second and third *Vertebra*, and each being immediately divided into two branches, the fore more thereof have each four twigs: The first is inserted into the long Muscle, or the first of the benders forward of the Neck; The second descending is bestowed upon the Muscles which lie under the *Oesophagus*, being first united to a twig of the fourth pair; The third ascending goeth to the Skin of the back-part of the Head, having first joined with the thicker twig of the hinder Nerve of the second pair: The fourth is bestowed

ed upon the transverse Muscles of the Neck, and the Muscle which lifteth up the Shoulder-blade. The *hinder* Branches are bestowed upon the second pair of Muscles which heave up or widen the Breast.

The *fourth* pair come out of the holes common *The fourth.* to the third and fourth *Vertebra*, the *formore* branches whereof are each divided into three twigs: The first of which uniting with a twig of the third pair is bestowed on the first of those Muscles which bend the Neck forward called *Longus* (as above said;) The second upon the transverse Muscle of the Neck, and the *Cucullaris* of the Shoulder-blade; The third being slenderer than the other two, is joined with a twig of the fifth pair, and both with one of the sixth, and lastly all three (according to Dr. *Willis*) with that of the second pair above-mentioned: and the Trunk *Nervus phrenicus.* made up of all these descendeth by the sides of the Gullet down the Neck and *Thorax* without any branchings till it come to the Diaphragm, where it is divided again into three or four twigs, on each side, and is inserted into its fleshy or muscular part, being known by the name of *Nervus diaphragmatis*, or *Phrenicus*, (of which we have discoursed more largely in Book II. Chap. 3. Of the *Midriff*.) The *hinder* branches go back to the spine under the Muscles of that part, upon which they bestow twigs, and going down between the muscles of each side of the Neck, each is carried to the *Musculus quadratus* of its own side that draweth the Cheek down.

The *fifth* pair issue out between the fourth and *The fifth.* fifth *Vertebra*, the *formore* branches whereof have each four twigs: The first goeth to those Muscles that bend the Neck forward: The second is that which joineth with the twigs of the second, fourth and

and sixth pairs, and makes up the *Nervus phrenicus*: The third goeth to the Muscle *Deltoides*: The fourth goeth to the same *Deltoides*, and to the *Coracobyoideus*, or the third Muscle of the *Oxyoides*. The *binder* branches bend back to the Spine, and are bestowed upon the Muscles there, as the like branches of the fourth pair were.

The sixth. The *sixth* pair come out between the fifth and sixth *Vertebra*. Their *formore* Branches send forth first one twig to make the Trunk of the *Nervus phrenicus*; then proceeding further they are united with the like branches of the three following pairs, namely, the last of the Neck and two first of the *Thorax*, making on each side one *Plexus* with them, out of which those Nerves proceed that are carried to the Arms. The *binder* branches go to the Muscles behind, which stretch out the Neck and Head, or bend them backward.

The seventh.

The *seventh* pair come out of the holes common to the sixth and seventh *Vertebra*. The *formore* and larger branches are joined with the like of the sixth of the Neck and two first of the *Thorax*, as aforesaid, furnishing Nerves to the Arms. The *binder* and smaller are bestowed upon the Muscles of the Neck, and quadrat Muscles which pull down the Cheeks.

Nervus ad par vagum accessorius.

About where these sixth or seventh pairs of Nerves rise, there springs on each side another Nerve, described by Dr. *Willis*, and by him called *Nervus spinalis ad par vagum accessorius*. They rise small out of the sides of the spinal Marrow, and ascend up by the sides of it, growing thicker as they go (but without being inserted anywhere into the Marrow) till having enter'd the Skull they are joined to the Fibres of the *par va-*

gum

Sum or eighth pair. Their progress from thence we observed in Chap. 13. when we described the eighth pair.

CHAP. XV.

Of the Nerves of the Vertebrae of the Thorax.

FROM the Marrow of the *Vertebrae* of the *Twelve of Thorax* spring twelve pair. In all of which *the Tho-* the formore branches are bigger; and the hin-^{rax.} der which are bestowed upon the Muscles seated on the Back, smaller.

The *first* pair spring out of the lateral holes *The first* which are common to the seventh *vertebra* of the *Pair.* Neck, and the first of the *Thorax*, and therefore it is indifferent whether they be esteemed to belong to the Neck or *Thorax*, some reckoning them to be the eighth pair of the Neck, and others (as we do here) the first of the *Thorax*. Each Nerve is presently divided (as all the rest are) into two branches; the *formore* of which are united to the like branches of the sixth and seventh of the Neck, as was noted in the fore-going Chapter, and are all spent on the Arms, except one little twig that springing out of the beginning of each archeth forward towards the *Sternum*, and be- loweth twigs on the *Musculus subclavius*, and those Muscles which arise from the top of the *Sternum*; and another that goes to that Muscle which fills up the hollownes of the Shoulder- blade. The *binder* branches creeping under the muscles which cleave to the *Vertebrae*, are bestow-

ed upon the Muscles of the Neck, Head and Shoulder-blades.

The second. The *second* issue out of the holes between the first and second *Vertebra* of the *Thorax*, the *fore* branches whereof are united with the like of the first of the *Thorax*, and together with them are joined to the *fore* branches of the sixth and seventh of the Neck, and these all together make one *Plexus* on each side (called *Axillar*) that sendeth forth all the Nerves to the Arms that they have, (as shall be further explained *Book IV. Chap. 3.*) But before the *fore* branches of this pair unite with the others, each sends a twig also to the *Intercostal Nerve* (or ninth pair) descending down the *Thorax*, (as also does every one of the remaining ten pair) and from that twig before it join with the *Intercostal* there proceed small slips to the Muscles that lie upon the *Thorax*. The *hinder* branches have the same distribution with the *hinder* of the foregoing pair.

The rest of the Pairs. The rest of the ten pair come out of the lateral holes betwixt the *Vertebrae*, and are all immediately divided on each side into two branches; whereof the *former* being larger, always send each of them one twig to the *Intercostal Nerve*, and the remainder of them is bestowed on the *Intercostal Muscles* internal and external, and on those that lie on the *Thorax*; as also on the obliquely descending Muscles of the *Abdomen*, &c. The *hinder* bend backward to the *Spine*, and are spread upon the Muscles and Skin of the Back.

C H A P. XVI.

Of the Nerves of the Vertebrae of the Loins.

OUT of the Marrow contained within the *Vertebra* of the Loins, arise five pair of Five of the Loins. Nerves. The *fore* branches being greater go to the Muscles of the Belly: The *hinder* to those which rest upon the *Vertebrae*. The *formore* (as *Spigelius* affirms) are joyned together, the first with the second, the second with the third, the third with the fourth, and the fourth with the fifth, as the two last of the Neck and two first of the *Thorax* were.

The *first* pair come out of the lateral holes between the last *Vertebra* of the *Thorax*, and the first of the Loins. The *fore* branches are bestowed upon the fleshy part of the Midriff, especially its hinder processes that are knit to the *Vertebrae* of the Loins, and on the Muscles *Psoæ*. Whence when there is a large stone in either Kidney, (the lower ends of the Kidneys resting upon the heads of these Muscles) this Nerve is compressed thereby, and from thence is a numbness extended to the Thigh of that side, because these Muscles terminate in the Thighs. These *fore* branches do each of them also send a twig along with the *Arteria mesepicæ* to the Stone, according to *Spigelius*. From whence it is, partly, that too immoderate Venery causeth a weakness in the Loins. The *hinder* are bestowed upon the *Musculus longissimus* of the Back, *Sacrolumbus*, &c.

The *second* come out between the first and second *Vertebra* of the Loins, under the Muscles *Psoæ*, (which are the first pair of those that bend

the Thighs.) The *formore* branches are bestowed upon the second pair of those Muscles that bend the Thighs, which fill up the cavities of *Ossa Ilea*, and on the *Musculi fasciales* and the Skin of the Thighs. The *hinder* are bestowed upon the *Musculi glutæi*, and the membranous pair of Muscles which extend the Leg. Each of those twigs which from this pair join with the Intercostal, goeth to the *Testis* of its own side (according to *Vesalius*, &c.)

The third. The *third* pass out of the holes between the second and third *Vertebra*, under the *Psoæ* also. The *formore* branches each of them send one twig to the Knee and the Skin thereof, and another which doth accompany the *Saphæna* down the Leg. The *hinder* turn back, and are bestowed upon the Muscles which rest upon the Loins.

The fourth. The *fourth* issue out between the third and fourth *Vertebra* being the largest of the Nerves of the Loins, and marching under the *Psoæ* and *Ossa pubis*, accompany the Crural Veins and Arteries.

The fifth. The *fifth* come out between the fourth and fifth *Vertebra*. The *fore* branches pass through the holes that are between the bones of the *Coxæ*, *dix*, *Pubes* and *Ileum*, (one on each side) and are bestowed upon the *Obturatores Musculi* of the Thigh, the Muscles of the *Penis*, and on the neck of the Bladder, and of the Womb. The *hinder* are bestowed upon the Muscles and Skin which lie upon the *Vertebra*.

C H A P. XVII.

Of the Nerves which arise from the Marrow of Os sacrum.

FROM the Marrow of *Os sacrum* six pair of Nerves spring. *Six of Os sacrum.*

The first issue out between the last *Vertebra* of the Loins, and the first of *Os sacrum*, in the same manner as those that spring out of the *Vertebra* of the Loins, and like them are each divided into two branches. The fore branches are a great part of them mixed with those other of the Loins that go towards the Thighs, yet each sends forth a twig that is dispensed to the Muscles of the Belly, and to the second bender of the Thigh. The hinder are bestowed upon the Skin of the Buttocks, and the greatest *Glutæi*. *The first pair.*

The other five pair spring after a different manner from the foregoing. For before they come out of the *Os sacrum*, they are every of them double on each side; and so from each on either side there arise two Nerves, one of which is carried into the fore or inner, and the other into the hinder or outer side. The three uppermost Nerves go towards the Thighs, as the greatest part of the first pair did: The two lower to the Muscles of the *Anus* and Bladder; in Men to the *Penis*, in Women to the neck and *vagina* of the Womb, and so to the outward Privity. All the five hinder Nerves are distributed to the Muscles of *Ossa Ilea* and *sacrum*, towards the back part, which are *Longissimi*, *Sacro-lumbi*, *Sacri*, and the *Glutæi*. *Of the other five pair.*

How the *Brachial* and *Crural* Nerves are formed out of the Nerves of the Spine, shall be more particularly, but briefly, shewn in the next Book.

And thus we have done with all the *thirty* pair of Nerves that arise out of the *Spinal marrow*, having shewn which way they pass, and to what parts they are distributed: which should be diligently noted, that we may the better know to what place to apply Remedies when from any outward Cause, as from a fall, bruise or the like, any part has lost either sense or motion, or both. For the Medicine is to be applied always to the beginning or rise of that Nerve that passes to that part, and not to the place in which the symptom appears. And the same thing is to be observed in Palsies, when the use of some particular Limb is taken away from an inward cause.

The Blood-vessels of the Spinal marrow.

Having finished our discourse of the Vessels that spring from the *Spinal marrow*, we will add a word to what was said above, Ch. 8. of the *Blood-vessels* that are dispersed through it, from Dr. Willis. These are of three sorts, *Arteries*, *Sinus* and *Veins*. It is supplied with *Arteries* after one manner above the Heart, and after another below it. For above it, seeing the trunk of the *Aorta* is presently cleft into many branches, which depart from the Spine therefore from its Axillar branches there springs a *Vertebral Artery* on each side, which ascending streight to the *Occiput*, sends a twig in at every joyniting of the *Vertebrae*: But below the Heart, inasmuch as the *Aorta* in its whole descent lies upon the Spine, there are received into the Spine two *Arteries* from its back side, betwixt every joyniting of the *Vertebrae*. But both above and below, the *Arterial* branches that are carried toward the Spine being presently divided each into two, one twig is bestowed on the neighbouring Muscles, and the

other enters in at the joynting of the *Vertebræ*, within whose cavity it is subdivided into three other twigs, two of which are bestowed on the *Medulla* (with its two Membranes) and the third on the Membrane that lines the inside of the *Vertebra* before. How these branches of Arteries inosculate with one another, may better be conceived by the said *Author's* draught of them in his *Tab. 13.* than by a verbal description. I therefore remit the Reader thither. The *Sinus*, he says, are continued from the lateral *Sinus* of the Brain, and all along the Spinal marrow they lie under the Arteries, having one Vessel to receive the Blood from the Arteries, and another to deliver it to the Veins, serving for the same uses as those of the Brain did, which were shewn above in Chap. 3. of this Book. Its *Veins*, like the Arteries, are communicated to it different ways *above*, and *below* the Heart. *Above*, a branch arising from the trunk of *Vena cava* below the subclavian, accompanieth the Vertebral Artery up to the *Occiput*, sending a twig in at every jointing of the *vertebræ*: but *below* the Heart, because the trunk of *Vena cava* does not, like the *Aorta*, lie immediately upon the Spine, and so cannot immit twigs into it directly, therefore it sends out of it self *Vena sine pari*, out of whose trunk two branches springing, and each of those being divided into two, one of them is bestowed on the neighbouring Muscles, and the other enters the Spine. Yet below the Kidneys, when there is lieve given to the *Vena cava* to be carried near the Spine, the *Vena sine pari* ends, and the *vasa Lumbaria* proceed immediately from the Trunk of the *Vena cava* as well as from the Trunk of the great Artery. The branchings of the *Sinus* and *Veins* within the Spine and their *anastomoses* are curiously delineated in the

aforesaid *Tab. 13* which deserves to be consulted by the Reader.

C H A P. XVIII.

Of the Face and its Parts.

IN the former *Chapters* we have discoursed of that part of the Head that is decked with Hair called *Calva*, of the Brain, &c. contained within it, of the *Medulla oblongata* arising out of it and prolonged into the *Medulla spinalis*, with the Nerves that spring out of the same both within the Skull and in the Spine, all which we have considered as Appendages to the Brain, seeing both the Marrow out of which they arise, springs out of it, and also all the Nerves have their Animal Spirits from it. Next we come to speak of the smooth or unhairly Part, called *Facies*, the Face.

Now though all the parts of the Body sufficiently shew the Wisdom of the Creator; yet both the beauty of the Face, and its admirable consent with the Mind doth epitomise as it were the comeliness and dignity of all the other parts, and exhibits their affections as in a Glass. For from it are not only taken signs of health, diseases, and imminent death; but also most clear tokens of the very disposition, manners and affections of the Mind. For as shame and frightenedness betray themselves in the *Cheeks*; so do anger, joy, sadness, hatred, and especially love, in the *Eyes*. So from the *Fore-head* are known ones gravity and humility: from the *Eye-brows* (or *Supercilia*) pride; from the *Nose*, sagacity or blockishness;

&c.

&c. from the *motion* of the Face, wisdom or foolishness, honesty or wickedness, civility or incivility, good-will or hatred; from its *colour*, the temperament of the whole Body. Besides, the sex, the age, the stock, and one Man from another may be distinguished by the Face.

The *Parts* of the Face are either *containing*, or *The Parts contained*, *of the Face*.

The *containing* are *proper*, or *common*.

The *common* are sufficiently described in *Book I. Chap. 3.* as not differing from the common integuments in other parts of the Body. Only here the *Membrana carnosæ* from the Eyes to the Chin is so thin that some have affirmed there is none: but in the Brows it is thicker, and cleaves very close to the Skin.

The *proper* are the *Muscles*, *Bones* and *Cartilages*, which shall each be described in their proper places.

The parts *contained* are the Eyes, Ears, Mouth and Nose, and many besides, which shall be treated of in the following *Chapters* of this *Book*.

The Face is divided into its *upper* and *lower* part. The *upper* is from the Hair of the Skull to the Eye-brows, and is called *Frons* the Fore-head, which while the Body is intire belongs to the Face, but in a *Skeleton* to the Skull. This is not to be treated of here, as consisting of no proper parts but *Muscles* and a *Bone*, which are to be described in their proper Books. The *lower* is extended from the Eye-brows to the Chin, and includes all the parts betwixt them; and to the description of these we now proceed.

CHAP.

C H A P. XIX.

Of the Eyes in general, and their outward or containing Parts.

THE Eyes (in Latin *Oculi*, from *occludo* to shut, or *occulto* to hide, because they lie hid under the Eye-lids) are the Organs of sight, consisting of many similar parts; and are as the two Luminaries of the Microcosm, to afford us light; or like two Watch-men placed in the upper part of the Body as in a Watch-tower, to give notice of any approaching Danger.

Their Number.

They are in *Number* two, partly to make the sight stronger; and partly that one being hurt, the other might perform the function of seeing in some measure, though more imperfectly.

Figure.

The Eye alone, divested of its Muscles, is of a round or sphaerical shape, both that it might move the better in its orbit, and also that it might more conveniently receive the visible Rays.

Colour.

The Colour of the Eyes in *Men* is sometimes grey, sometimes brownish, sometimes black: which variety is most conspicuous about the *Pupilla* in the *Iris*, and proceeds from the colour of the *Uvea*. *Brutes* of the same species have not that diversity of Colours.

Signes.

Some have much larger Eyes than others; but those which are largest and stand much out, have not so acute and piercing a sight as those that are less and stand further in.

Consent.

There is a great *Consent* betwixt them, so that one being moved towards any Object, the other is moved towards the same. The Reason whereof we inquired before *Chap. 11.*

Some

Some think they have a kind of congenit or *Light*. inbred *Light*, without which they could not see ; even as the Ears have a congenit Air within their Cavities, without which they could not hear.

They are each placed in a large Cavity, called *Situation*, *Orbita* (or a Socket) on each side the Nose, which is hollowed out of the bones of the Skull. And these orbits are invested on their inside with the *Pericranium* , to which the fat and origins of the Muscles cleave firmly. These may be reckoned the first containing parts of the Eye ; as may also, in the second place,

The *Palpebræ* or *Eye-lids*, which serve as Cur- *The Eye-* tains to the Eyes, by which dust and troublesome *lids*. smokes and vapours, too much light and the injuries of the Air are kept out, and the outward tunicle of the Eye called *Adnata*, but especially that called *Cornea*, which covereth the *Iris* and *Pupilla*, is moistened, wip'd and clean'd. They consist outwardly of a very thin Skin which has no fat under it ; inwardly they are lined with the *Pericranium*, that is here most thin and smooth. Betwixt these parts comes the *Membrana carnosæ*, which is also very thin. Each Eye has two. In Man the lower is less, and is but very obscurely moved in comparison with the upper : but in Birds the lower is the larger, and in most seems only to be moved, the upper remaining unmoveable. *Steno* mentions several *puncta lachrymalia* in their inner Membrane, which run on each side into one Duct, (called by him *Collicia*) whereby the superfluous moisture of the Eye-lids is conveyed into the Nostrils. At their edges they have little soft Cartilages, (called *Cilia* in Latin) to strengthen them, and that they may meet the more exactly. Upon these Cartilages there grow Hairs, which having attained to a certain length, will natu-

Cilia.

Supercilia.

naturally grow no longer, so that they never need to be cut. Those on the upper Eye-lid turn something upwards, and those on the lower downwards. Above the upper Eye-lid grow also a Sett of Hairs, betwixt it and the Fore-head, out of the *Supercilia* or Eye-brows; these lie pretty flat bending from within outwards, and hinder sweat from the Brow, dust or other things from falling into the Eyes.

Canthi.
Their
Glands.

Whence
Tears pro-
ceed.

The Eye-lids have two corners called *Canthi*. The *outer* of these is less, and in its upper part it has a Gland placed (usually called *Innominata*, or nameless, but might be named *lachrymalis*, as affording the most of that *Lympha* that makes the Tears.) This Gland is conglomerate, being made up of many lesser, and has small twigs of Arteries that creep to it, and depolite *Serum* or *Lympha* in it to supply matter for *Tears* upon occasion. But the ordinary use of this *Lympha* is to moisten the inside of the Eye-lids, and the Superficies of the Eyes, that they may move more glibly. *Steno* has observed that in a Calf the fore-part of this Gland is elegantly divided into Lobes (being indented on its edge) and that betwixt the intervals of these there pass out excretory Vessels from the Gland, which running forward within the inner coat of the Eye-lid make little holes in it at a little distance from the *Cilia*, thro' which they discharge their humour. And he doubts not but there are such Vessels in Men, in whom he calls them *vasa lachrymalia*. *Diemerbroeck* having reckoned eight opinions concerning the cause, origin and matter of tears, rejects them all, and this we have mentioned with the rest: and thinks that their matter is the more serous and thin particles of the pituitous humour collected in the Brain, and flowing to the Eyes upon its contraction, through

through the *Foramen lachrymale* seated at the inner corner of the Eye. Which the Reader may see defended in his *Anat. lib. 3. cap. 15.* There is another spongy and soft Gland in the inner *Canthus* or Corner, seated upon the *Foramen lachrymale*, which helps the former in its office, but is not above a third part so big. Dr. Briggs says, there are two or three lymphatick Vessels that receive *Lympha* from it, and end in the inside of the Eye-lid, and that eight arise out of the former Gland, and end in the *Tunica adnata*, where they continually deposite something of *Lympha*, to keep the Eye moist. *Nerves* come to them from the *fifth* pair, which communicating with the *Intercostal*, are much irritated in the passions of sudden joy or of sadness, and so twitch and compress these Glands that the *Lympha* is squeezed or milked as it were out of them, as Dr. Willis ingeniously supposes. *Steno* thinks, that in weeping, the flux of tears is principally owing to the contraction of the capillary Veins, by which means the Blood and *serum* cannot be so quickly carried back from these Glands as they are brought to them by the Arteries, and therefore the *serum* oozes out (as blood has also been observed to do sometimes.) Which Opinion differs not much from Dr. Willis's, if we will suppose the contraction of the Veins to be owing to the Nerves, as it is reasonable we should.

As for the *Muscles* of the Eye, they shall be described in the Fifth Book.

C H A P. XX.

Of the Tunicles of the Eye.

HAVING done with the outward or *containing* parts of the Eye, we come now to the Eye it self, and first of its *Tunicles*.

The Tunicles of the Eye, one common.

The outmost *Tunicle* of the Eye is *common*, and is called *Adnata*. It springs from the *Pericranium*, and is spread over all the White of the Eye above the *Sclerotica*, reaching as far as the *Iris*. By this the Eye is kept firmly within its orbit, from whence it is also called *conjunctiva*. It is of very exquisite sence, and has many capillary Veins and Arteries creeping through it, which are most conspicuous in an Ophthalmy or inflammation of the Eyes. Under this *Tunicle* are the Tendons of the Muscles extended and expanded to the circumference of the *Iris*, which increase its whiteness; and some take them for a second *Tunicle* calling it *Innominata*.

Three proper.
1. Sclerotica.

The *proper* *Tunicles* of the Eye are three, according to the threefold substance of the Optic Nerve. For this Nerve (as all the other) consists of two *Tunicles* springing from the *Dura* and *Pia Mater*, and an inner marrowy substance. From the *Dura Mater* springeth the outmost coat of the Nerve, and from this the *Tunicle* that spread next under the *Adnata*, called *Sclerotica* from its hardness; but in its forepart where covereth the *Iris* and *Pupilla*, it is named *Cornea* from its transparency; though sometimes the latter name includes the whole *Tunicle*, as we see behind and on the sides, as before.

That which lieth next under the *Cornea* is much thinner than it, and is called *Choroïdes*, from its resembling the Membrane *Chorion* wherein the *Fœtus* is included in the Womb. Its fore-part is otherwise called *Uvea*, because it is somewhat of the colour of a Grape. This springs from the *Pia Mater*, and is spread from the bottom or centre of the Eye behind, all over the Eye to the *Pupilla*; to whose circumference when it is come, it becomes double, making with one part the *Iris*, with the other the *Ligamentum ciliare*. On the inside it is of a dusky colour, (in Man) but blacker on the outside. But where it makes the *Iris*, it is of divers colours resembling the Rainbow, from whence it borrows its name: yet in some it is more blue, in others black, in others grey. This Tunic is perforated before as wide as the *Pupilla* (or sight of the Eye) to permit the rays of visible species to pass in to the crystalline humour. Next unto which crystalline humour lies the *Ligamentum ciliare*, the second part of the duplicated *Uvea*. This consists of slender Filaments or Fibres, (like the Hairs of the Eye-lids) running like so many black lines from the circumference of the *Uvea* to the sides of the crystalline humour, which they encompass, and widen or constrict as there is occasion, by contracting or opening the *Foramen* of the *Uvea*.

2. Choroïdes.

The third Tunic is made of the medullar substance of the Optick Nerve, and is called *Retiformis* (Net-like:) This seemeth to be the principal Organ of Sight. For, as Dr. Briggs well argues, neither the crystalline humour, through which the rays pass much refracted; nor the Tunic *Choroïdes*, are at all fit for this use. For this latter part (as arising from the *Pia Mater*) cannot communicate the impressions of the rays

3. Retiformis.
This the principal Organ of sight.

to

to the medullar part of the Brain, which it does not at all touch. Whereas the medullar Fibres of the *Retina* have communication therewith, as springing therefrom, and therefore can well perform that office. The Fibres of this Tunicle are extended from the bottom or inner centre of the Eye, where the Optick Nerve enters it, as far as the *Ligamentum ciliare*, (to which it affords Animal Spirits for the continuance of its motion.) If one take this *Tunica Retina* and put it into warm water, shaking it a little, to wash off the mucous substance that cleaves to it, and then hold it up to the light, these Filaments will appear very numerous like the threads of the finest Lawn.

C H A P. XXI.

Of the Humours and Vessels of the Eye.

The humours of the Eye three.

NExt to the Tunicles of the Eyes are the *Humours* contained in them to be considered. And these are in number three, viz. *Aqueus*, *CrySTALLINUS*, and *VITREUS*. The second weighs as much again as the first, and yet not so much as the third by a sixth part. The Crystalline is the most dense of consistence by much; and the glassie more dense than the watry.

1. *Aqueus*. The *Aqueous* humour is outermost, being pellucid and of no colour (as neither are the other two.) It fills up that space that is betwixt the *Cornea* and the Crystalline humour before. If any thickish particles swim in it, then Gnats, Flies, Spiders webs and the like will seem to be flying before the Eyes. But if those particles grow still thicker, and close together so as to make a film

and this be spread before the hole of the *Pupilla*, then is the sight quite taken away, which disease is called a *Cataract*. This Humour is very clear, and thin, and therefore easily dissippable; but by which way its expence should be supplied, is difficult to determine. Some think it is fed by the Arteries out of which this water issues through I know not what Glands: others derive it from the Nerves, and a third sort from the Lympheducts. But Dr. *Ant. Nuck* refutes all these Opinions; the first from the non-appearance of any Glands; the second from the no (or at the most a very small quantity of) liquor that at any time can be observed in the Nerves: whereas if the *tunica cornea* be prick'd, and all or the greatest part of this aqueous humour be let out, he has found by repeated Experiments that it will be recruited again in six hours space. The third Opinion he refutes from the general office of Lympheducts, which is, to bring back from the circumference to the centre, and not contrarily, because the valves wherewith they every where abound cannot admit of that motion. Wherefore exploding all these Opinions, he establishes a new one of his own, upon the score of the new Vessels that he has observed to terminate in the *tunica cornea*, (which he calls *ductus oculorum aquosi*, which we shall describe from him by and by) affirming, that these Ducts are the Conduits by which this humour is fed, and that they supply it ordinarily with several drops daily, because of the continual transpiration of it by pores looking from within outwards. As to the particles of this Humour, from several Experiments he has made, he thinks it is demonstrable; 1. that it contains in it a very limpid and pellucid water. 2. Viscid and tenacious particles. 3. A salt and

an acid. 4. Earthy particles. 5. That it wants not also its volatil spirit.

2. *Crystallinus.*

The *Crystalline* humour (so called from its being as clearly transparent as Crystal) is placed betwixt the aqueous and the vitreous, but not exactly in the middle or centre of the Eye, but rather towards its fore-part. It is inclosed in the bosom as it were of the vitreous humour, and is flattish on the fore-side, but rounder behind. It is more bright and solid than either of the other two. It has been the common Opinion that it is inclosed in its proper Membrane, which is called either *Crystallina* from its transparency, or *Aranæa* from its most fine contexture. But Dr. Brigg, a very accurate Anatomizer of the Eye, denies any such Tunicle, affirming that it is merely adventitious when the humour is exposed for some while to the Air, or is gently boiled. As to the collection or reception of the rays of things visible, this humour is the primary instrument of sight: though as was said before, the *tunica retina* is the principal as to perception, because through it the rays are communicated to the common sensory.

3. *Vitreus.*

The third and last Humour of the Eye is the *Vitreous*, so called because it is like to molten Glass. This is thicker than the Aqueous, but thinner than the Crystalline; and much exceeds them both in quantity, for it fills up all the inner or hinder hemisphere of the globe of the Eye, and a pretty deal (toward the lateral superficies) of the formore. It is round behind, but hollowed in the middle forwards, to receive the Crystalline into its bosom. This humour is also said to be separated from the other two by a proper Tunicle called *Vitrea*, which the aforesaid ingenious Author likewise denies.

See the Situation of these Humours represented in Fig. II. of Tab. 15. inserted p. 417.

The Eyes have *Arteries* from the *Carotides*, ^{The Vessels of the Eye.} which bestow twigs on their Muscles, and on their Tunics. And these are accompanied with *Veins* springing from the Branches of the Jugulars. As for their *Nerves*, they either assist the sense of seeing, and are called the Optick Nerves, which we have reckoned for the second pair, and described before Chap. 10. or serve for the moving of them, being inserted into their Muscles, and to this purpose serve the third and fourth pair, and some twigs of the fifth. As to their *Lympheducts*, we have spoken of them above, Chap. 19. when we discoursed of the Glands placed at each *Canthus* or Corner of the Eye-lids. Besides these Vessels, Dr. Ant. Nuck, whom we cited but just now, has discovered a fifth sort of Vessel, called by him *ductus oculorum aquosi*, which he believes do recruit the continual consumption of the watry humour of the Eye. He says they are of an uncertain number, and may be plainly discerned to run along the *tunica sclerotica*, and to penetrate at length the *cornea*, where their Orifices have such a Valve as the Ureters have in the Urinary Bladder, or the *porus bilarius* in the *vesica fellea*. In the *tunica sclerotica* and *cornea* they are of a dusky colour, but not before they arrive thereat. They admit of a Probe of a pretty bigness, and are of a stronger make than Lympheducts. He has taken great pains to trace them to their Origine, but has not yet been able to follow them further than to the Optick Nerve. So that he knows not whether their rise may be from some Gland not yet discovered, or whether the *Glandula pituitaria* may not send forth some shoots that constitute these Ducts.

The Action of the Eyes. The *Action* of the Eyes is *Vision*. Which is very well defined by *Diemerbroeck*. viz. That it is a sense whereby, from the various motion of visible Rays collected in the crystalline and vitreous humours, and darting upon the tunica retina, the Colours of visible Objects are perceived, with their site, distance, greatness, figure and number ;] the medium of which perception is the light. But we shall not enter upon a discourse of Vision here, as being more proper for a Philosopher than an Anatomist.

CHAP. XXII.

Of the Auricula.

The Ears. AS the Eyes are placed in the upper part of the Body like two Watch-men to descry approaching danger ; so are the Ears there seated also, that they might give information of what the Eyes cannot discover either in the night for want of light, or through the interposition of some thick and opaque Body which the Sight cannot penetrate. And as the Eyes contemplate the wonderful works of God, whereby the Mind may conceive of his infinity ; so the Ears are the Inlets or Receivers of Verbal Instruction in Wisdom and Science. For they are the Organs of Hearing, and are in number two, that the one may fail, yet we might hear with the other. They are placed in the Head, because Sounds ascend.

Their Parts. The *Parts* of the Ear are either outward or inward. The outward is called *Auricula*, which is only an adjutant Instrument of Hearing, being spread like a Van to gather and receive the sounds.

Its upper part is called *Ala* or *Pinna* the Wing; ^{The Names of its Parts.} and its lower or soft Lobe, usually *Infima Auri-*
cula. It has several protuberances or eminences, and cavities. Its outmost *protuberance* that makes its circumference, from its winding is called *Helix*; and that which is opposite to it, *Anthelix*: but that next the Temple, because in some it is hairy, is called *Hircus* or *Tragus*; and that which is opposite to it, to which the soft Lobe of the Ear is annexed, *Antitragus*, which likewise in some is hairy. Its Cavities are three. The inmost because of the yellow Ear-wax (as we call it) that is gathered in it, is named *Alvearium*; as also *Meatus Auditorius*; (of which more in the next Chapter.) The next to this outwards which is bigger, from its tortuosity or winding is called *Concha*. The third is that betwixt the *Helix* and *Anthelix*, which has had no Name imposed on it.

The constituent Parts of the *Auricula* are either *its constituent Parts.* common or proper. The common are *Cuticula*, *Cutis*, and *Fat* in the Lobe. The proper are the *Muscles*, *Veins*, *Arteries*, *Nerves*, the *Cartilage*, and the *nervous Membrane* or *Tegument* which immediately embraces the whole *Cartilage*, which some reckon to the common Parts. As concerning the *Muscles*, they are set down in their proper Treatise. The *Veins* come from the external *Jugulars*; the *Arteries* from the *Carotides*; the *Nerves* from the second Pair of the Neck, being joined with the harder process of the seventh Pair. As for the *Cartilage*, it is a substance that is fittest for this place. For if the Auricle had been bony, it might by many Accidents have been broken off; or if it had been fleshy or only membranous, it would not have stood so spreading, but have sunk down. Whereas a *Cartilage* is not in dan-

ger of breaking, and yet it is stiff enough to keep this outer part of the Ear expanded. It is tied to *Os petrosum* by a strong Ligament which riseth from the *Pericranium*.

Uses.

The *Uses* of the outward Ear or *Auricle* are these: First, it serveth for Beauty. Secondly, it helps the receiving of the Sounds. For first, it gathereth them being dispersed in the Air. Secondly, it doth moderate their *Impetus*, so that they come gently to the *Tympanum*. Such as have it cut off upon any occasion, are very much prejudic'd in their Hearing, which becomes confus'd with a certain murmur or swooning like the Fall of waters.

Parotides.

Both behind and below each Ear, there are several Glands outwardly under the Skin, that are called *Parotides*. But there are two more notable than the rest, near one another; of which one is lesser, and is *conglobate*; but the other bigger, consisting as it were of many lesser, and is *conglomerate*. From the *conglobate*, according to *Steno*, there arise *Lympheducts*, returning the *lymph* that is separated in them into the *Jugular Veins*; and in the *conglomerate* the *saliva* is separated which is conveyed into the Mouth by proper *Ducts*: but of these more by and by, in Chapter 26.

C H A P. XXIII.

Of the inward Part of the Ear.

THE inward Part of the Ear is that which we properly call *Auris*, and begins at the *Meatus Auditorius*, or that inmost Cavity of the Auricle in which the Ear-wax is collected. The

*Meatus
Auditori-
us.*

The Cavity

Cavity ascends something with a winding Duct, that the vehement *Impetus* of Sounds may be a little infringed before they vibrate upon the *Tympanum*. *Monf. du Verney* (that has lately writ a particular Treatise of the Ear) says, that this *meatus* or tube that reaches from the *Concha* to the *Tympanum*, consists partly of a Cartilage, and partly of a Bone. The Skin that covers it, he says, is *The Ear* furnished with an infinite number of Glandules ^{max.} of a yellowish colour, each of which has its Tube opening into this *Meatus*, by which they send that yellow glewy substance which is ordinarily found in it, and hinders Insects from creeping into the Ear, entangling them like Bird-lime.

Before its inner end is spread the *Tympanum* or ^{The Tym-} Drum, which is a nervous, almost round and pellucid Membrane, of most exquisite sense, dividing the outward from the inner Ear. Some will have it to spring from the *Pericranium*, others from the *Pia Mater*, a third sort from the *Dura Mater*, a fourth from the softer process of the Auditory Nerve expanded. And lastly, some think that it has a proper substance, springing from no other Membrane, but made in the first formation of the parts. It is very dry, that it might give the better sound. It is strong, that it should the better endure external Harms. It is inclosed in a chanel or rift made in the circumference of the outer end of the Bone that joins to the Cartilage which forms the largest part of the *Meatus*, and it has a Cord that runs cross it behind, which some take for a Ligament to strengthen it; but *du Verney* says it is a branch of the seventh pair of Nerves, which supplies twigs to the Muscles that move the *Tympanum*: (for it hath two Muscles to move it, which shall be described in the Fifth Book, Chap. 8.)

G g 4

When

*The first
Cavity.*

When it is taken away, there appears a *Cavity* on the inside of it, which by some is also called *Tympanum*, but by *du Verney*, the *Barrel*. He says, it is a quarter of an inch long, and half an inch wide. It is encompassed round with Bone, and clad within with a Membrane that is interwoven with a great number of Vessels.

*its four lit-
tle Bones.*

In this Cavity are contained *four* little Bones that are moveable, and conduce much to Hearing. They have no Marrow in them, nor are covered with any Membrane or *Periostrum*; yet at their extremities where they are joyned, they are bound with a small Ligament one to another. And they have this also peculiar to themselves, that they are as big in Infants as in grown persons, as are also the Bones of the *Labyrinth* and *Cochlea*, according to *Veslingius* and *du Verney*.

*1. Malle-
olus.*

The *first* is called *Malleolus*, the little Hammer. It hath a round Head, which is inarticulated into the Cavity of the Anvil by a loose Ligament. This Head is continued into a small Neck or Handle, which reaching beyond the middle of the *Tympanum*, adhereth to it. About the middle it hath two processes: The one of which, being shorter but thicker, has the Tendon of the internal Muscle inserted into it; and the other being longer but smaller, the Tendon of the external, whereby this Bone immediately, but mediately the *Tympanum* is moved, as shall be further explained in the *Chapter* of the Fifth Book. And see *Tab. 16.* before-going wherein all these four Bones with the Muscles are represented.

2. Incus.

The *second* is called *Incus*, the Anvil, having one Head, and two Feet, being somewhat like one of the grinding or double Teeth that has two roots, onely one of its Feet is considerably longer than the other. The Head is pretty massie, ha-
ving

ving in the top of it a little smooth cavity, which receiveth the knob or head of the Hammer. The smallest (but longest) Foot is tied to the top or head of the Stirrop by a loose but firm Ligament; but the thickest, broadest and shortest resteth upon the *Os squamosum*.

The third is *Stapes*, or the Stirrop. This is not so compact and solid as the two former, but more porous. In Figure it is almost triangular, in the middle hollow, to give way to the passing of the Air to the *Labyrinth*. In the upper part of it is a very small and round knob, upon which the longest foot of the Anvil resteth. Its Shape is much adapted to the *Fenestra ovalis* (which opens into the *Labyrinth*) about which it is tied round somewhat loosely, so that it may be driven to within its *Sinus*, but cannot without violence be pulled outwards.

The fourth Bone was found out by *Franc. Sylvius*, and from its round shape is called *Orbiculare*. It is tied by a slender Ligament to the side of the *Stapes*, where the *Stapes* is joined to the *Incus*. *Wernsey* says, that this Bone comes betwixt the long foot of the Anvil and the knob or head of the Stirrop: And that on that side next the Head of the Stirrop it is convex, being received into a little Cavity of the said Head; and on that side next the Foot of the Anvil it is a little hollow, receiving the said Foot into it self.

From the lower side of this first inner Cavity, wherein these Bones are contained, there is a *Meatus* or Chanel to the Palate of the Mouth near the root of the *Uvula*; and another from its upper side that runs to the cavity of the Nostril, as formerly been taught; but the aforesaid Author describing it to be much wider, but a great deal shorter than the other, says, That it penetrates to within the sinuosities of the mammillary process.

Os orbiculare.

Two Chd.
vel.

process of the Temple-bone. Those who thought it to run to the Nostrils, supposed it to convey thither pituitous Matter collected within this first Cavity ; but *du Verney* thinks its use to be, to permit the internal Air to retire into the sinuosities of the aforesaid process when the *Tympanum* is driven inwards by the external Air, and that the internal Air returns from thence again upon the relaxation of the *Tympanum*. And as to the former chanel, he calls it an *Aqueduct*, and says, that its first and shorter part is bony, but the second and longer partly cartilaginous and partly membranous which part passing near the root of the Nose is lined with a glandulous skin that is a continuation of that which cloaths the inside of the Nostrils. So that he believes that part of the Air which is drawn in at the Nose penetrates this chanel (and so may ascend to the Ear) and on the contrary thinks that aqueous humours descend by it into the mouth by its aperture in the Palate ; for he denies that there is any Valve in it which might stop any thing from passing either way. Other Authors (not denying this latter use, but not supposing that it had any communication with the Nostrils ; instead of the former use derived from thence) have thought, that air and all sounds might pass through it in at the Mouth to the Ear, by observing that those who are thick hearing do usually hold their mouths open when they listen attentively, which they do probably because they are partly assisted thereby in the hearing.

Two holes.

In the middle also of this cavity opposite to the *Tympanum*, in the *os petrosum* there are two holes the greater and higher of which is shut by the basis of the *Stapes* (when no sounds affect the Ear) and is of an oval figure, whence it is called *Fovea*

Fenestra ovalis, and opens inwards or backwards pretty wide into the Labyrinth. The other is less and lower, and is of a round shape, whence it is called *Rotunda*. The Orifice of this is open, but within the middle of its chanel it has a rift wherein is inclosed a thin, dry and transparent Membrane like that of the *Tympanum*. Behind which it is divided into two Pipes divided by the *Os squamosum*, one of which tends to the *Cochlea*, the other to the Labyrinth.

This Labyrinth is the *second inner cavity*, being far less than the former, and was first so called by *Fallopius*, from the hollowed bony semicircles (cloathed with a thin membrane) returning circularly into the same cavity. The *Fenestra ovalis* and *rotunda* open into it out of the first cavity: and besides these holes it has five others, one of which opens into the end of the larger *Gyrus* or winding of the *Cochlea*: The other four are so small that they hardly admit an hair, through which the most slender Fibres of the auditory Nerve proceed to the inner membrane that encompasses this cavity.

The *third* and last inner cavity is called *Cochlea*, because in its spiral winding it resembles a Snail's shell. It is less than the Labyrinth, and has two, sometimes three or four spiral windings, which are cloathed inwardly with a most thin Membrane, into which, as into the Labyrinth, the slender Fibres of the auditory Nerve enter, through three or four very small holes.

Du Verney makes but two inner cavities, viz, the *Barrel* (which we described above) and the Labyrinth. But then he divides the Labyrinth into three parts: the foremost of which he calls the *Vestibulum* or Entrance; the second comprehends the three semicircular conduits or chanel, which

which (he says) are on that side of the Vestible which is towards the hinder part of the Head ; and the third is the *Cochlea*, which is on the other side. But this new distinction is of less moment, and therefore I pass it over. As for the shape of the *Labyrinth* and *Cochlea*, it is shewn before in *Tab. 16*. But they are represented much larger than according to nature, as are also the Bones in the first cavity, that their parts might appear more plainly.

The congenit Air.

These three inner Cavities are all formed within the *Processus petrosus* of the Temple-bone, and in them is contained a most pure and subtil Air, which some think to be included in them in the very first formation of the parts, and therefore call it *Aer Insitus* and *Congenitus*. Some suppose it to be Animal spirit, effused into them by the auditory Nerve.

The vessels of the Ear.

This inner part of the Ear has *Veins*, *Arteries*, and *Nerves* from the same origines as the outer ; only the *harder* process of the auditory Nerve goes to the outer, and the *softer* to this inner, which coming by the hinder *Meatus* of the *Oss petrosum* is inserted into and dispersed through the circles of the *Cochlea* and *Labyrinth*.

Hearing what, and how performed.

All the parts of the *Auricula* and *Auris* concur to the perfecting the *Hearing*, which is a Sense whereby sound is perceived from the various trembling motion of the external Air, beating upon the *Tympanum*, and thereby moving the internal Air with the *Fibres* of the auditory Nerve, and communicating to the common Sensory. Now Sound that is the object of it, is nothing else but a quality arising from the Air or Water beat upon and broken by the sudden and vehement concussion of solid Bodies. And the diversity or greatness of such sound is distinguished by the four Bones that stand on the

infid

inside the *Tympanum* : For as from the greater or less, gentle or harsh impulses of the external sonorous Air (fluctuating like Waves caused by a Stone thrown into the Water) the Membrane of the *Tympanum* is accordingly driven or shak'd against the *Malleus*, the *Malleus* against the *Incus*, and the *Incus* against the *Stapes* ; so, as the same *Stapes* and *Os orbiculare* open the *Fenestra ovalis* more or less, is there a freer or straiter passage granted to the internal Air out of the first inner cavity into the Labyrinth and *Cochlea*, in whose tortuous and unequal windings it is variously intruded and modulated, from whence the *species* of sound that is made thereby, (according to the diversity of the external impellent) is sometimes more acute, sometimes more full, sometimes more harsh, sometimes more gentle, sometimes bigger, sometimes less : the *Idea* of which *Species* is carried to the common Sensory, (and so represented to the mind) by the auditory Nerve that expands itself through the Membrane that invests the said Labyrinth and *Cochlea*.

C H A P. XXIV.

Of the Nose.

THE Organs of *Seeing* and *Hearing* being described in the foregoing Chapters, we come now to the Instrument of the third Sense, viz. Smelling, which is the *Nose*.

The parts of the *Nose* may be distinguished into the more *external*, and the more *internal*. The more *external* parts are these, the Cuticle and Skin, Muscles, Veins, Arteries, Nerves, Lymphatics, a proper Duct, Bones and Cartilages. First,

Skin. the *Skin* cleaveth so fast to the *Muscles* and *Cartilages*, that it cannot be severed without rent.

Muscles. ing. Secondly, as for the *Muscles*, they are set down in the description of the *Muscles*, Book V.

Veins, Arteries and Nerves. Thirdly, the *Veins* come from the external *Jugulars*, as the *Arteries* from the *Carotides*. Fourthly, the *Nerves* spring from the fifth pair. Fifthly, *Steno* has observed in *Sheep* and *Dogs* a *Lymphatick* Vessel in each *Nostril*; and 'tis probable there are the same in men. Sixthly, Both *Steno* and *Dr. Needham* describe a *Meatus* or Duct, having two *foramina* in the *canthus* of the *Eye*, but opens but by one into the *Nose*: and *Dr. Needham* has observed another passage going out of the middle of this, toward the *Palate*. By which Ducts any one may perceive that in weeping, a great quantity of water doth flow from the *Eye*.

Bones. Seventhly, the *Bones* are described in Book V.

Cartilages. Chap. 6. Eighthly, the *Cartilages* are in number five; the two *upper* are broader, and adhere to the lower side of the *Bones* of the *Nose* where they are broader and rough, and being joined to one another pass from thence to the tip of the *Nose*, making up one half of the *Ala*: the two *under* make up the other half, being joined to the upper by a membranous ligament; the fifth divideth the *Nostrils*. These *Cartilages* are moved by the *Muscles*.

its inner
parts.
A glandu-
lous Mem-
brane.

The *inner* parts of the *Nose* are these: First the *Membrane* which covereth its inside, which some think proceedeth from the *Dura Mater*, passing through the holes of the *Os cribriforme* with the nervous *Fibres*. This *Membrane* on its inner side hath abundance of little *Papillæ* or *Glands* in which the *Serum* or *Rheum* is separated that runs out by the *Nose*, (though *Diemerbroeck* thinks them to be the true Organ of Smelling.)

Second

Secondly, the *Hairs*, called in Latine *Vibrissi*, ^{Hair.} which hinder the entrance of insects and of dust in a great measure, as one draws his breath in at his Nose. Thirdly, the red fleshy spongy substance, with which the holes of the *Os spongiosum* ^{Spongy flesh.} in the upper side of the Nostril are filled up; from which the *Polypus* springeth.

The length of a comely Nose is the third part ^{Length.} of the length of the Face.

The upper part of the Nose which is bony, is ^{The denomination of its parts.} called *Dorsum Nasi*, or the ridge. The lower lateral parts *Ala* or *Pinna*. The tip of the Nose, *Globulus*, and *Orbiculus*. The middle cartilaginous partition, *Septum*; and the fleshy part, that at the bottom of the *Septum* reaches from the tip of the Nose to the root of the upper Lip, *Columella*. The two holes that are caused by the partition, are called *Nares* the Nostrils. And these about their middle are each divided into two, one of which goes up to the *Os cribriforme*, to convey scents thither: the other descends down upon the Palate to the *Fauces*, by which Rheum falls down either of its own accord if it be very thin; or by snuffing the Air up strongly in at one's Nose, if it be thick, which we may hawk and spit out at pleasure.

The Nose is an external adjuvant organ of ^{its parts.} smelling, as the *Auricula* is of Hearing. For when smells exhale out of odoriferous bodies into the air, by taking our breath in at the Nose, the scents accompanying the air ascend up the Nostrils to the top of their Cavity, viz. to the *Os cribriforme*, through whose holes the olfactory Nerves (otherwise called *processus mammillares*) issue out by their Fibres, and are dispersed through the Membrane that cloaths the inside of the Nostrils, especially its upper part: which Nerves, Fibres

Fibres and Membrane are the *inward* immediate and *adequate* organ of Smelling. Other inferior *uses* the Nose has also: as first, sometimes to take in our breath by, that we may not keep our Mouth always open for that purpose. Secondly to help the Speech, which is very much impaired by the loss of it. Thirdly, it serves for the separation and discharge of the mucous humours in the Blood.

CHAP. XXV.

Of the external parts of the Mouth.

The outer parts of the Mouth.

THE next part to be described is the Mouth whose parts are either *External* or *Internal*. The *External* are the *Cheeks* and *Lips*.

The Cheeks.

As to the *Cheeks*, their substance being Muscular, this is no proper place for their description (but Book V.) only we shall note from Stern that betwixt their Muscles and the inner investing Membrane of the Mouth there is spread on each side towards the lower Gums a large conglomerate Gland, from whence many small Ducts open into the cavity of the Mouth, pouring *Saliva* thereinto. And as to their parts we shall observe this further, that their upper part near under the Eyes, that jets out a little and is commonly highest of colour, is called *Malum* or *Pomum faciei*, in English commonly the Ball of the Cheek; and their lower part that is stretched out in blowing of a Trumpet or the like, is called *Bucca*.

Their glands.

The Lips.

The *Lips* are framed of a carnos soft fungous substance, and of the Muscles, covered with

thin Skin, under which, on the inside, especially of the lower Lip, there lie numerous Glands, whose excretory Vessels penetrate the Skin, pouring forth their *Saliva* into the Mouth. They are in number two, the upper and the lower. (Of their *Muscles* see Book V.) The upper Lip has a little dimple in its middle which is called *Philtrum*; and its sides are named *μὺς αχέ*, whence the hair that grows thereon is called *Mustaches*.

The *Uses* of the *Lips* are these: First, they help to retain the Meat in the Mouth, while it is chewing. Secondly, they serve for beautifying of the Face, if they be well fashioned. Thirdly, for the containing of the Spittle in the Mouth, that it should not drivel out constantly, but be spit out when we please. Fourthly to keep the Gums and Teeth from external Injuries. Fifthly, for framing of the Speech.

The uses of the Lips.

C H A P. XXVI.

Of the inner Parts of the Mouth.

THE inner Parts of the Mouth are these: The inner The Gums, the Teeth, the Palate or Roof of the Mouth, the Almonds, the Uvula, the Tongue, the Glands and salival Ducts.

The Gums (*Gingivæ*) are two, made up of 1. Gums. a hard fleshy substance, destitute of motion, set like a Rampire about the Teeth for the keeping of them in their Sockets.

As for the Teeth, look for them in Book VI. 2. Teeth. Chap. 8.

The Roof of the Mouth is its upper part, something concave like a Vault, formed in the Os sphenoides,

H h

noides,

noides, and serves partly for perfecting of the Voice by reperculsing the Air, and partly assists the Sense of Tasting. It consists of Bones (of which, Book VI. Chap. 6.) of a peculiar glandulous Flesh and a thick Tunicle, full of little holes for the *Saliva* that is separated in the Glands to destill through into the Mouth. *Steno* calls this glandulous flesh, the *palatine Gland*, and says, it is conglomerate, and continued to the *Tonsils*; and that there spring out of it innumerable slender Ducts, which perforating the Membrane make it like a Sieve. The same Author mentions also two holes that it has in its fore-part, just within the Teeth, which come from the Nostrils.

4. *Almonds*. Of the *Tonsilla* or Almonds we have spoken before in Book II. Chap. ult.

5. *Uvula*. The *Uvula* is a red, spongy and longish Caruncle, that being somewhat broad at its Basis hangs down from the middle of the Palate (where the Nostrils open into the Mouth) with a small but bluntish End. It is covered with a very lax and soft Skin, and is often swelled with Defluxions of Rheum, hanging down flabby, which is called the falling of the *Uvula*, and by ignorant People, the falling of the Root of the Mouth.

6. *Tongue*. The *Tongue* (*Lingua*, à *lingendo*, from licking) is the Instrument of Taste and Speech. It is long and broad, thicker at the Root than towards the Tip.

Its Mem-
branes.

It is clothed with two *Membranes*; The outer covers onely the upper part of the Tongue, and is very porous, being pretty smooth in Men, but in some Brutes it is rough, by reason of abundance of copped bodies which arise out of the upper surface of the Tongue, and are clothed with this Membrane. Which Bodies are of a cartilaginous substance, and stand like the Teeth of Wooll.

Wooll-cards, bending towards the root of the Tongue. This Membrane has a line that runs lengthways of it in its middle, dividing the Tongue into two parts. The *inner* covers the whole Tongue, the lower side as well as the upper. This is thin and soft, and has many *Papillæ* protuberating out of it, which in the upper part of the Tongue intrude themselves into the pores of the outer. *Malpighius* makes the outer Membrane to be that which cloaths the sides and under side of the Tongue as well as its upper side: and this which we call the second, he names a nervous and papillar body, running through the upper surface of the Tongue like a Membrane.

As to the *substance* of the Tongue there is great diversity of Opinions. Some think it to be a Gland; others, that it has a peculiar substance; *Spigelius*, that it is truly a Muscle; and so does *Dr. Wharton* call it *verus Musculus*, though towards its root (he saith) it hath something of a glandulous substance. *Malpighius* (*exercit. Epistol. de lingua, p. 9.*) says, it is rather musculous than glandulous, and describes its substance thus.

“Immediately under the aforesaid Membranes
 “there lie streight fleshy muscular Fibres, where-
 “by the Tongue is drawn inwards and shortned.
 “But the centre of the Tongue consists of a ma-
 “nifold kind of Fibres, long, transverse and ob-
 “lique, which riding one upon another are in-
 “terwoven like a Mat. This inner part is softer
 “and more luscious to the taste than the outer;
 “not that it is of another substance, but because
 “it is loosened and larded as it were by a cer-
 “tain luscious fat that (especially toward the ba-
 “sis) fills up the Interstices of the Fibres; and
 “there are moreover on the sides of the Fibres
 “in this place a sort of miliary Glands which

“give it the more pleasant relish.] But though this be its substance, yet it cannot properly be called a Muscle, both because no Muscle serves to move it self, but some other part; and also because one Muscle is not moved by another, as the Tongue is by several pair, to be described Book V.

Connexion. It is *connected* to the *Os hyoides*, *Larynx*, and *Fauces*, and by a membranous Ligament to the parts under it. The extremity of which Ligament is called *Franum*, which being too short, or extended to the tip of the Tongue, hindreth sucking in Children, when they are said to be Tongue-tied.

Vessels. Its *Veins* proceed from the external Jugulars, and are very apparent under the Tongue, where they are called *Ranulares*. The *Arteries* come from the *Carotides*. *Nerves* it hath from the fifth and eighth pairs.

Actions and uses. The *actions* and *uses* of the Tongue are these. First, it is the Instrument of Tasting; especially the *Papilla* in its inner Membrane, which have nervous filaments (running amongst the fleshy fibres) inserted into them. Secondly, it formeth or modulateth the Speech. Thirdly, it helpeth the chewing of meat, by tossing of it to and fro, and turns it down into the Gullet.

7. *Glands.* Besides the *Glands* already mentioned there are several others, some of which are placed in the Mouth, and others, though not seated therein, yet discharge into it by proper Ducts that liquor that is separated in them, and therefore are properly enough to be treated of here.

Parotides. The first are the *Parotides*, which are of two sorts, *Conglobate* and *Conglomerate*, and are both seated in the hollow under the Ear. The *Conglobate* are situated on the upper and fore-side of the *Conglomerate*. The *Conglomerate* are of an irregular

regular shape, such as the inequalities and eminences of the circumjacent parts grant to them. They were both of them formerly reputed E-munctories of the Brain, and supposed to serve likewise for the sustentation of the Vessels that ascend this way. But *Steno*, and from him others have found out more noble and genuine uses for them. The *Conglobate* separate the *Lympha* from the Arterial blood, and conduct it by *Lympheducts* into the Jugular Veins. The *Conglomerate* have not only inserted into them Veins and Arteries from the external Jugulars, and *Carotides*, and Nerves from the harder branch of the seventh pair; but also there springs out of each a peculiar Vessel commonly called a *Salival duct*, Their saliv. ducts from the liquor it conveys. This Vessel arises out of it by many small roots, that presently unite into one Trunk, which running on the outside of the upper Jaw-bone by a streight course (in man) as far as to the centre of the *Musculus buccinator*, there opens into the cavity of the mouth, into which it discharges the *Saliva* which it had imbibed out of the *Parotis* of its own side. This is called *Ductus salivaris Stenonianus*, from its Inventor *Steno*; or otherwise *Superior*, to distinguish it from the maxillar which is the lower. As to the origine and use of the *Saliva*, we shall speak thereof by and by.

The second Glands I call *Nuckianæ*, being Nuckianæ lately first described, with the Salival ducts proceeding from them, by Dr. *Ant. Nuck* a Dutchman. They are seated in the orbit of the Skull wherein the Eye is placed, betwixt the abducent muscle of the Eye, and the upper part of *Ossis jugale*. Their shape is various, in some oblong, in others flattish round, in others oval, and in others somewhat triangular. Each weighs com-

Their saliv-
al ducts.

monly half a dram or somewhat more. They have *Arteries* from the *Carotides*, *Veins* from the *Jugulars*, *Nerves* from the *motory* pair of the *Eyes*; and he thinks there is no doubt but they have *Lymphaticks*. Each has a *Salival Duct* springing out of it by many roots, which descends streight downwards on the outside of the *Jaw-bone*, till it come to the upper part of the *Gum* in the upper *Jaw* near to the second double *Tooth* reckoning from behind forwards, where it empties it self very near the *Stenonian* one. He calls them *Ductus salivales superiores alteri*, to distinguish them from the foregoing.

Maxil-
laries.

The next *Glands* are the *Maxillar*, which are either *External*, or *Internal*. The *External* are of less moment, being very small. They are seated outwardly about the middle of the lower *Jaw*, where the outer branch of the *Carotid Artery*, and the external *Jugular Vein*, with a remarkable branch of the fifth pair of *Nerves* ascend into the *Muscles* of the *Face*. It is probable these have no other use, but to separate *Lympha*, and to convey it into the neighbouring *Jugular Veins*. The *Internal* are seated immediately within the lower *Jaw*. Their hinder side which is next to the *Parotides* and *Jugular Glands*, is much thicker and rounder, as also redder: but as they reach forwards, they wax thinner by degrees, and are extended betwixt the *Jaw* and the *Muscles* of the *Tongue* as far forward as to the *Chin*, as *Dr. Wharton* affirms. They are *Conglomerate*, and have each a proper *Vessel* (first found out by the said Author) arising out of them as the conglomerate *Parotides* had: which *Vessels* are called the *inner* or *lower Salival ducts*, as those springing from the *Parotides*, the *outer* or *upper*; these running on the inside of the lower *Jaw*, as those did

Their saliv-
al ducts.

on the outside of the upper. These Vessels spring by many small roots out of the thicker and hinder part of the Glands, and run streight forwards towards the Chin, but in their passage each trunk does here and there receive new twigs springing out of the Gland. When they are come to the middle of the Chin, they end there just within the Gums, and have each a certain *papilla* affixed to their Orifice, whereby they can easily discharge themselves, and yet nothing return out of the mouth into them.

The last Glands to be treated of are the *Sub-Sublinguales*, to the first discovery whereof and of ^{guales.} their proper Salival ducts, several pretend. They lie underneath the Tongue on each side, and each of them sends forth a proper excretory Vessel or salival Duct, which running parallel with those of the internal maxillar Glands, open in the same *papilla*, but have a peculiar Orifice of their own, straiter than that of the other.

Now the *use* of all these Glands is to separate ^{The use of the glands and saliva.} the *Saliva*, and to convey it into the mouth by the salival Ducts. As to the Origine of the *Saliva*, it is most probably derived from the Arterial blood. For as the Arteries pour nutritious blood into all other parts, so they do into the Glands also; part of which they convert into their own nourishment, part is returned by the Veins in the circulation, and part (*viz.* of what is ferous) they separate, and bestowing a subacid quality thereupon make *Saliva* (or Spittle) of it.

To the composition whereof (if not for the separation of it) some think a nervous juice is contributed, the rather because larger and more numerous twigs of Nerves are communicated to the Glands than to most other parts, which yet have a more exquisite sense than these. But in refutation

tation of this Opinion, the above-mentioned Dr. Nuck alledges this Experiment : " That if the " Nerve that runs to any Gland be either hard " tied or cut in sunder, yet the secretion of the " *Saliva* will not thereupon cease, but will only " proceed more slowly ;] which slowness may be attributed, not to the want of any constitutive principle of the *Saliva*, so much as to the want of that motion in the Gland (that to be sure depends as well upon the Nerve as upon the pulsation of the Artery) which is necessary for the quicker dispatch of the *Saliva* through or out of the Gland. I shall not need to discourse of the manner of the secretion of the *Saliva* in the Glands, seeing it proceeds like the secretion of other parts, (*v. g.* of the Kidneys) *viz.* from the conformity of the particles of the liquor to the pores in the Gland or the mouths of the excretory Vessel. After its separation, its motion into and along the Lympheducts is much furthered by the muscular motion of each part respectively. Now the *Saliva* is not to be reputed a meer Excrement, for it is believed by all modern Anatomists, that it serves for the furthering of the fermentation of Meats in the Stomach, if it be not the main ferment of it, as was shewed in Book I. Chap. 7. That it has a fermentative quality *Diemerbroeck* proves by this Experiment : That if a piece of white Bread be chewed and moisten'd with much Spittle, and then be mixed with Wheat-paste kneaded with warm Water, it will make it ferment. Dr. Nuck thinks it is an universal ferment for Meats and Drinks, partaking of divers qualities (or particles) but of none in any excessive degree. That it is acid, he demonstrates by this familiar Observation : " That if when Milk is a boiling, one take
" a Spoon-

"a Spoonful to taste of, and then presently
"whilst it is moist with the *Saliva*, put it into
"the Milk again (still a boiling) the Milk will
"break as if some acid liquor were mixed with
"it.] That it is endued with a volatile Salt,
he thinks is evident from its curing the Itch, Tet-
ters, &c. That oleous particles are mixed with
the acid, he supposes must be concluded from its
killing Quicksilver. And whereas it usually be-
comes frothy in the mouth upon its being agita-
ted by the motion of the Muscles of the Tongue,
and those which move the lower Jaw, that he
thinks proceeds from its being endued with a lixi-
vial salt and spirituous oleous and acid particles,
(while the volatile spirit vanishes.)

The End of the Third Book.

The



The Fourth Book.

Containing

A Description

OF THE

Veins, Arteries and Nerves

OF THE

L I M B S :

With an APPENDIX of
the *GLANDS* thereof.

C H A P. I.

Of the Veins of the Arm.

IN the three former Books we have finished the Description of the three Cavities or Ventricles of the Body : out of which those *Vessels* arising that are propagated to the *Limbs*, it seems convenient to subjoin thereunto a short Treatise of the courſe that thoſe Veſſels keep in theſe Parts.

In Book II. Chap. 9. treating of the Ascending Trunk of the *Vena cava*, we shewed, that when it arrived at the top of the *Thorax* it was divided into two branches called *Rami subclavii*; which running obliquely under the *Clavicula*, as soon as they were past them and come to the Arm-pit, were called *Axillares*. Now each of these parteth it self into two Veins, the *Cephalica* and *Basilica*. But before their Division they send forth two small Veins, viz. *Scapularis interna* and *externa*; whereof the first passeth to the Muscles that lie in the cavity or inside of the *Scapula*, the latter to those on the outside.

Cephalica.

The *Cephalica* passeth through the upper or outward part of the Arm, to the bending of the Elbow, where it is divided into two branches: of the which one, joining with the *Basilica*, makes the *Mediana*, which is very frequently opened when one is let blood in the Arm: The other, marching along the *Radius*, reacheth to the Hand, through which it is spread; but chiefly in that part which is between the Ring-finger and the little Finger, where it is called *Salvatella*.

Basilica.

The *Basilica* passeth through the inner and lower part of the Arm, accompanied with the Artery and Nerves.

About its beginning there spring out of it the *Thoracica superior* and *inferior*, (though sometimes these arise from the Axillar before its division) of which the former runs to the inside of the Pectoral Muscle, &c. the latter to the *Musculus latissimus* of the Back, and all over the side of the *Thorax*, where 'tis said to inosculate with the twigs of *Vena sine pari*.

its Branches.

Basilica about the bending of the Elbow is divided into two; one of which is called *Subcutanea*.

Profunda, because it lies hid deep in the flesh.

The *Subcutanea*, or shallowest branch, near its *Subcutanea* origin turns up to the outer part of the *Ulna*,^{nea} and is carried along it to the Hand.

The *Profunda* descends between the *Ulna* and *Profunda*, *Radius*, (but towards the Wrist is carried by the outer part of the *Ulna*) to the Hand also.

The *Mediana* is also double, *profunda* and *The Mediana*, *subcutanea*; both which run by many *Twigs*^{ana} through the Muscles of the Cubit to the Hand and Fingers.

Note, That since the Circulation of the Blood has been generally believed, it is held indifferent which of these three Veins (the *Cephalica*, *Basilica*, or *Mediana*) are open'd in blood-letting; for they all receive their *Blood* from one common Artery, *viz.* the *Axillar*, which returns by them all indifferently towards the Heart: onely it is best to open that which is fairest.

C H A P. II.

Of the Arteries of the Arm.

AS soon as the *Subclavian* Branches of the ascending Trunk of the *Aorta* are past out of the *Thorax*, they are called *Axillar*, (like the Veins) as we shewed in Book II. Chap. 11.

This Artery before it arrive at the Arm sendeth out of its upper part *Humeraria*, which is bestowed on the Muscles of the Shoulder: and out of its lower, *Thoracica superior*, *inferior* and *scapularis*, which run to the same parts with the Veins of the like denomination in the foregoing Chapter.

Chapter. Then having communicated small twigs to the Glands in the Arm-pit, it accompanieth the *Basilica* along the Arm, (for there is no Cephalick Artery.) When it is come to the bending of the Elbow, it is parted into two Branches, which pass almost wholly to the inner side of the hand; for the backside hath no Artery but from a small twig that runs betwixt it and the bone of the Thumb.

The one of these resting upon the *Radius*, is that which beats about the Wrist, and is commonly felt by Physicians.

The other marcheth by the *Ulna*, and with the former is spread through the Hand.

C H A P. III.

Of the Nerves of the Arm.

THE *Nerves* that spring from betwixt the two lowest *Vertebra* of the Neck, and the first two of the Back, (some say, three of the Neck and three of the Back) do every one send a branch towards the Arm; all which for the greater strength uniting with one another, and again separating are carried under the *Clavicle* to the Arm-pit, where they unite together again and are called *Axillar*; but they pass out from thence again separate one from another. The first of them goes to the Muscle *Deltoides*, to the second Muscle of *Os hyoides*, and to the Skin of the Arm. All the other five are bestowed wholly on the Muscles and Skin of the Arm and Hand.

CHAP. IV.

Of the Veins of the Thigh, Leg, and Foot.

THE Iliacal Branches of the *Vena cava* after they are descended as far as the Thigh where we left them *Book I. Ch. 13.*) are called *Crurales*, which being past the Groins are each divided into six more notable Veins, viz. *Saphæna*, *Ischias major* and *minor*, *Muscula*, *Poplitea* and *Cruralis*. The first called *Saphæna* descends down on the inside of the Thigh and Leg betwixt the Skin and *Membrana carnosæ*, and appears pretty large on the inside of the Ankle, where it is frequently opened in Diseases of the Womb, and may with great safety, having neither Artery nor Nerve accompanying of it. The *Ischias major* is that which runs down on the outside of the Ankle where it is wont to be opened in the *Sciatica*, or other distempers of the Hips;) but the *minor* goes no further than the Muscles of the Hip. The other three are spent on the Muscles, Skin, &c. of the Thigh, Leg and Foot.

CHAP. V.

Of the Arteries of the Thigh, Leg, and Foot.

IN *Book II. Ch. 11.* describing the descending Branches of the *Aorta*, we traced them to the Thighs, where the *Rami Iliaci* begin to be called *Crurales*, as was said of the Veins. The Crural Artery

Artery is less than the Vein, and before it arrive at the Ham sendeth forth three Branches, viz. *Muscula cruralis exterior, interior*; and *Poplitea*. The first enters the fore Muscles, the second the inner Muscles of the Thigh; and the third runs down the hinder Muscles as low as the Ham, whence it has its name. When the trunk of the Crural Artery is past the Ham, it sends out three more called *Tibiaa exterior, posterior elatior* and *posterior humilior*, which are bestowed on the Muscles, Skin, &c. of the Leg and Foot; and what remains of it descends to the Foot, upon which it is spent.

CHAP. VI.

Of the Nerves of the Thigh, Leg, and Foot.

THE three lower pair of Nerves of the *Vertebrae* of the Loins, and the four uppermost of *Os sacrum* constitute the Crural Nerves. For all these very near their Rise joining together, and proceeding united for a while, make four Nerves. The first and third enter the Muscles that lie upon the Thigh-bone, whether for its Motion, or of the Leg. The second accompanies the Crural Vein and Artery down by the Groins and the inside of the Thigh, on whose formore Muscles it is most of it spent, but sends one notable Branch down the Leg, as far as to the great Toe. The fourth is the thickest, hardest, and strongest of all the Nerves in the Body. This distributeth Twigs to the Skin of the Buttocks and Thigh.

Thigh, to the Muscles of the Thigh and Leg, and being descended to the Ham is divided into the outer and inner Branches, which bestow Twigs on all the Muscles and Skin of the Leg and Foot, to which there comes no other Nerve, but the aforesaid Branch of the second.

A N
APPENDIX
TO
BOOK IV.

Of the GLANDS of the Limbs.

HAVING finished the Description of the Vessels of the Limbs, this seems the fittest place to mention the *Glands* of the same, seeing these minister to those, either as supporting them in their passage, according to the Ancients; or as separating *Lympha* from the Arteries, according to some Moderns, (or Superfluities from the Nerves, according to others) and returning the same by Lympheducts into the Veins.

The most considerable of these *Glands* are *Glands of* those in the Groin and Arm-pit. The former *the Groin* are called *Bubones*, (not only when swelled, but *and Arm-* also in their natural state) and are commonly *pit.* about eight. The latter are called *Axillares*, from their situation. These are smaller than the
li other,

other, and fewer in number, seldom exceeding three.

Their Use.

The Groins and Arm-pits the Ancients called Emunctories; the one of the Belly, the other of the Breast. And, besides the supporting of the divisions of the Vessels, all the Use assigned to these Glands, was to imbibe a moisture from the Blood for the nourishment of the Hair that grows in these parts. But seeing in the Groins where the most and largest Glands are, there grows little or no hair, (most of that, growing upon the region of the *Os Pubis* where are no Glands at all) this seems not to be the proper use of them, and indeed it is too trifling and vile. The true Use, as of all other conglobate Glands (of which sort these are) is, to separate the *Lympha* from the Arterial Blood, and to transmit it by the Lympheducts into the Veins, in which it is conveyed back together with the Venal Blood to the Heart.

The Pope's Eye.

In the middle of the Thigh on the inside (about the middle of the length of the *Musculus sartorius*) is a pretty considerable Gland, which we commonly call in Sheep the *Nut* or *Pope's Eye*. This is of the same kind and use with the former. As for the *Mucilaginous Glands* of the Joints, lately found out and accurately described by the ingenious and sedulous Dr. *Havers*, they shall be particularly taken notice of in the VI. Book of the *Bones*, where the respective Joints to which they belong, are described.

The End of the Fourth Book.

The Fifth Book.

CONTAINING

A Treatise of all the

MUSCLES

Of the BODY.

CHAP. I.

Of a Muscle in general, and of its parts.

A Muscle in Greek is called $\mu\upsilon\sigma$, a mouse, (of *A Muscle*, which *Musculus* in Latine is but a diminutive) either because it resembles a fley'd mouse; or else from $\mu\upsilon\omega$, to contract, which is its action. And under this denomination is understood all that which is properly called flesh; which is not one continued substance through the whole Body, but consists of divers parts or parcels, that have no continuation of substance, but lie only contiguous to one another in such convenient and decent order and situation, as may conduce to the comeliness of the Body, and the performance of each one's particular office.

Definition.

Now a Muscle is rightly defined to be a *dissimilar* or *organical part*, (framed of its proper Membrane, fibrous flesh, a Tendon, Vein, Artery and Nerve) appointed by nature to be the *Instrument of free motion*.

By which definition seeing it appears to be a dissimilar part, consisting of many similar, we shall in the first place examin what these are. They are either *common* or *proper*. The *common* are three: The Vein, the Artery and the Nerve. The *proper* as many, *viz.* the fibrous flesh, the Membrane and the Tendon.

Constitutive parts, viz. common and proper. The common are Arteries, Veins, and Nerves.

The *Arteries* convey to the Muscles, (as to all the other parts of the Body) Vital heat and nourishment; and according to Dr. *Willis*, a *latex* that in motion effervesces with the Animal Spirits; the *Veins* carry back from them what blood is not assimilated to them; and the *Nerves* bring Animal spirit whereby their action is performed. And these Nerves spring either from the *medulla oblongata* within the Brain; or from the *spinalis*, so called after it is descended out of the Skull into the Spine. Dr. *Willis* is of opinion, that the Nerve which enters every particular Muscle, is single and peculiar from its very Original, though it be included in a common coat with many others: otherwise he cannot conceive how the Animal spirits which are directed by the Soul along the Trunk of any Nerve, for such on such a particular motion, should hit the way into one branch rather than another. As soon as it hath entred into the substance of the Muscle, it is divided into innumerable twigs, which in a little space from its insertion become so very slender and fine, that they escape the sight. Some make Lymphatick Vessels common parts of a Muscle but according to *Steno's* observation, though they

run along their surface, they do not enter into them.

Now these are called the *common* parts of Muscles, because they are common to them with other parts of the Body that are endowed with the same kind of Vessels. But as to each particular Muscle, they have every one their peculiar and proper Vessels, numerically distinct. That is, though those twigs of Vessels that are inserted into one Muscle, be propagated from the same Trunks from which other twigs pass to other Muscles; yet those twigs, whether of Arteries, Veins or Nerves, that are bestowed on one Muscle, are wholly spent thereon, and pass not out through its investing Membrane again to any other.

The *proper* parts are so called, because they are proper and peculiar to a Muscle, and not common to any other part.

The first of these is *fibrous flesh*, or *fleshy fibres*, which some distinguish into two parts, *fibres* and *flesh*: and fibres again into *fleshy*, and *membranous*.

A *Fibre* is thus defined by Dr. Glisson in Cap. 4. de Ventric. *A Body in figure like a thread, slender, tenacious, tensile, and irritable, made of spermatical matter, for the sake of some motion and strength.* Which he thus explains; "*In figure like a thread*"] i. e. oblong and round; *slender*] like a Spider's web: *tenacious*] whose parts firmly cohere and are not easily broken; *tensile*] viz. that may be extended as to longitude, its latitude being less'n'd, and in like manner that may be thicken'd as to latitude, its longitude being shorten'd; *irritable*] i. e. which by irritation may be excited to contract it self, and the irritation ceasing, to be remitted of its own accord; *made of spermatical matter*] namely if it be a bare *Fibre*;

“but if it be stuff with a *parenchyma*, perhaps it
 “is not always made of only *spermatick* matter;
 “(for the stuff Fibres may be divided into san-
 “guineous and *spermatick*; of the former kind
 “are those of the Muscles; of the latter, those
 “of the Stomach and Guts:) *for the sake of some*
 “*motion and strength*] for in that it is tenacious it
 “adds strength to the part, and that which is
 “apt to be extended and contracted, is destin’d
 “for some motion.]

*Their
 course.*

These *fleshy fibres* are commonly *streight*, but
 not always, for sometimes they run round, as in
 the Sphincters.

(2.) *Mem-
 branous.*

Besides these *fleshy Fibres*, some later Anato-
 mists describe another sort which they call *mem-
 branous*, running from Tendon to Tendon over-
 thwart the other, cloathing them and knitting
 them to one another; and make them to com-
 municate to the fleshy ones their motory instinct,
 and also to convey to the Tendons the Spirits
 which flow into the belly of the Muscle by the
 Nerves, as likewise the same Spirits from the
 Tendons back again to the belly of the Muscle,
 as there is occasion.

*Flesh what,
 and of what
 made.*

The Fibres being stuff in their Interstices
 with a sanguineous *parenchyma*, are that which we
 properly call *flesh*. For (saith Dr. Croone) all the
 flesh of a Muscle (which makes the greatest part
 of it, and of which the bulk of the whole Body
 chiefly consists) seems to be nothing else but that
 portion of the blood that flows through the inter-
 vals of the Fibres, which thickning by their cold-
 ness is staid amongst them. *Steno* denies any *pa-
 renchyma*; and says, that every Fibre is tendinous
 at both ends, and carnous in the middle: and
 that the same Fibres which being straitly knit to
 one another, make the Tendon; being more
 loosely

loosly joyned, make that we call flesh. With him consent most of the more modern Anatomists, who will have all the fleshy fibres vascular or tubular, and to be filled with a fluid. But though we should grant they are, yet I think it is necessary, besides them, to allow of a *parenchyma*; otherwise, the Muscles of slaughter'd Animals would more considerably abate of their bulk, for a good part of this fluid must needs be derived out of the fibres, and be evacuated together with the blood. For nothing can come into the fibres, but out of the blood; and upon depletion of the blood-vessels, what should hinder the same from returning out of the fibres into those vessels again? And a *parenchyma* is further demonstrated, in that in some muscles in fat people the (lean) flesh is interlarded with fat, which fat yet is not a necessary part of a Muscle, seeing it is not in all Muscles even in fat persons; and in very lean, in none.

Every Muscle hath a proper *Membrane* that invests it, and distinguishes it from others. Where-
 2. A Mem-
 brane.
 to its Origine is owing, is difficult to determine. 'Tis most probable, that 'tis made out of the Fibres expanding themselves at their ends; to conceive which we must understand that the Fibres run not lengthways of the Muscle so as to reach from one end of it to the other; but from one side of it to another, yet not directly but a little sloping. Notwithstanding (so long as they continue fleshy) they are streight in figure, if you consider them apart, and run parallel one by the side of another. But supposing this to be the Origine of this Membrane, (which I propose as doubtful) we must not conceive that the Fibres are wholly spent thereupon so as to terminate there; for under this Membrane they run

(being divested of their *parenchyma*) lengthways of the Muscle, and constitute its Tendon.

3. A Ten-
don.
Its defini-
tion.

The last proper part of a Muscle is the Tendon, which *Spigelius* defines thus: It is a similar and simple part, of a peculiar kind, diffused through the whole body of the Muscle lengthways, which in some part thereof is united, (and there it is white with a kind of brightness, dense, hard and smooth) and in some divided and stuffed with flesh (where it is not easily discernible:) and seeing it is very much adapted for contraction, when it is contracted at our pleasure, it moves together with it self that part into which it is inserted. *Steno* affirms the rise of a Muscle to be tendinous, as well as its insertion; and defines a Tendon to be a body continued from the beginning of Muscles to their end.

icles
use Ten-
dons.

All Muscles which are appointed for the moving of bones, have Tendons which are inserted into those bones they are to move: but commonly those which move other parts, as the Tongue, Lips, &c. as also the Sphincter of the Bladder, and anus, have none, or however such as are not easily discoverable; for indeed some affirm (as *Dr. Croone*) that every Muscle has its Tendon.

of what
they are
framed.

There are sundry Opinions as to the substance of a Tendon. *Spigelius* (as appears by the foregoing definition) thinks it to be a simple part, that is, truly similar, and not appearing so to the Eye only. He says, it is neither a Nerve, nor a Ligament, nor is it a substance mixt of both; but it is a part of its own proper kind, softer than a Ligament, and harder than a Nerve. *Vesalius* on the other hand affirms (with *Galen*) that it is a dissimilar body, composed of a concurrence of Fibres, Ligaments, and very slender Nerves, growing by degrees into one body. *Diemerbroeck* doubts

not but that the Nerve which enters into any Muscle, is extended as far as its Tendon (though it cannot be traced by the Eye thither) because of the very acute sense of the Tendon; and yet the Tendon, he says, is not a meer Nerve, but 'tis likely that the Fibres and Membrane with a Ligament are intermixed with it.] I think 'tis most probable, that it is only a production or prolongation of the Fibres freed from their *parenchyma*, and clothed with the investing Membrane of the Muscle, which it self seems also to be derived from the Fibres, as was noted above. But whatever its substance be determin'd to be, it has always been held to be the principal part of the Muscle, and the chief instrument of its action; though according to *Steno* it is not it self that contracts, but the fleshy Fibres by its means. Dr. *Willis* thinks that the Animal Spirits which reside in the Muscle, do in cessation from motion retire into the Tendons, and in motion are darted from thence into the *parenchymatous* or fleshy part, where they are joyned with more, flowing in by the Nerves.

The Tendons are sometimes round, as in the *Musculus biceps*; sometimes broad, as in the oblique and transverse Muscles of the Belly. *Their figure.*

These are the *parts constitutive* of a Muscle. It hath besides these, parts derived from the *Position* (or rather from its action) and those are three: The Head, the Tail, and the Belly. The *Head* or beginning is that part of the Muscle that arises from the part *unto* which the contraction is made: the *Tail* or *end* is that part of it which is inserted into the part which is moved: the *Belly* is all that (fleshy) part that lies betwixt the Head and Tail. *Steno* thinks the *Head* and *Tail* of a Muscle *The parts distinguished from the position.*

Muscle are better exprest by the *two Extremes* : seeing if that be the Head to which the contraction is made, then neither extream, but the middle or *belly* is the head, because both the extreams in contraction move towards it : or if any will contend that one end is moved towards the other, the same end is not always the quiescent one in all the motions of every Muscle ; and therefore the same end in several motions being sometimes the Head, and otherwhiles the Tail, this distinction breeds but a confusion.

*The use of
a Muscle.*

The *use* (or rather *action*) of a Muscle was intimated in the last part of the definition, in that it was said to be the instrument of *free* motion ; which word we rather make use of than of *voluntary*, because Beasts have Muscles and motion, unto whom *Will* properly so called is denied, because it supposeth Reason. But hereof more in the next Chapter.

C H A P. II.

Of the Differences and Action of the Muscles.

*The differences of
Muscles.*

THE Differences of Muscles are taken from sundry things: *First*, from their *Substance* : so some are fleshy, as most of the Tongue and Larynx : some are membranous, as the *Constrictores* or internal *Adductors* of the Nose : and some art partly fleshy, and partly nervous, as the temporal.

Secondly, from their *quantity* : whence some are *long*, as the streight Muscles of the *Abdomen*, the longest of the back, &c. others *short*, as the pyramidal

pyramidal at the bottom of the *Abdomen*: some broad, others narrow: some thick, others thin and slender, &c.

Thirdly, from their situation: from hence some are called *external*, some *internal*; some *oblique*, some *straight*, some *transverse*.

Fourthly, from their figure: as *Deltoides*, because it resembleth the Greek letter Δ *delta*; some round, others square, &c.

Fifthly, from their beginning: so some proceed from bones one or more: some from *Cartilages* or gristles, as those of the *Larynx*; and some from the Membrane that invests the Tendon of some other Muscle, as the *Lumbricales* of the Hands and Feet.

Sixthly, from their insertion: some being inserted into bones, as most are; some into *Cartilages*, as the Muscles of the Eye-lids, &c. others into a Membrane, as those of the Eye, &c.

Seventhly, from their composition or variety of parts; so some are called *bicipites* and *tricipites*, having two or three heads; others *biventres* having two bellies.

Eighthly, from their action: from whence four differences of Muscles are taken: for first, some are hence called *fraterni* or *congeneres*, brotherly, because they assist one another in their Action; some *antagonista*, Adversaries, because they have an opposite motion. Secondly, some only move themselves, as the *Sphincters*; some other parts, as the rest. Thirdly, some have one only action, as the greatest part of the Muscles; some have divers actions, as the *masseter* and *trapezius*. The fourth difference is taken from the variety of the action; so some are called *flexores*, others *extensores*; some *elevatores*, others *depressores*; some *adductores*,

adductores, others *abductores*. Others *suspensores*, *rotatores*, &c.

Thus much of the *Differences* of Muscles one from another: in the next place proceed we to their *Action*, in which they all agree.

Their
action.

Now the proper *Action* of a Muscle is the *contraction* of it self, whereby it brings the part from which it arises and that into which it is inserted, nearer to one another. But whether this contraction be from the repletion, or from the inanition of its Fibres, or by both these, or which way else, we shall not spend time to Philosophize, nor is it agreed on among learned men.

The efficient
cause, and
mediate in-
strument
whereof.

The *Efficient cause* of this Action is the Soul or the Loco-motive Animal Faculty, which being invited, or offended by some object, moves the whole body, or some member of it, in pursuance or avoidance thereof; of which motion the Muscle is the *immediate* instrument, but the Nerves conveying the Animal Spirits to the Muscle, are the *mediate*.

The differ-
ences of
their mo-
tion.

I said even now that the *proper* action of a Muscle is contraction, but that is not the only motion it is capable of, for Anatomists commonly ascribe to it four different motions: The *first* is that already mentioned, *viz.* contraction; the *second* is the perseverance of the contraction; the *third*, the relaxation of the contraction; and the *fourth*, the perseverance of the relaxation. The perseverance is called *motus tonicus*, whereas the member is still kept in the same posture.

These four motions are common to every particular Muscle: but there are others which agree some to one, some to another, in respect of their situation, or the course of their Fibres: So a streight Muscle hath a streight motion

motion; a transverse, a transverse motion; an oblique, an oblique; and a sphincter, an Orbicular.

As for the *reason* and *manner* of motion, where-
of different Authors have invented various *Hypo-* The reason
and manner
of motion.
theses; as it would be too large a task to examine
these; so I think it too difficult to explain those.
And therefore waving all such speculative and
conjectural Discourses, and frankly declaring with
Steno, That to me *non liquet*, I proceed to the
Description of the Muscles themselves, wherein
I may appeal to the Hand and Eye of any skilful
Dissector.

CHAP. III.

Of the Muscles of the Eye-lids and Fore-head.

THE upper Eye-lids are moved very mani-
festly, the lower more obscurely; where-
fore the upper have each a Muscle that the low-
er want, which is called *rectus* or *aperiens*, ser-
ving to pull it up. It is placed in the upper re-
gion of the orbit of the Eye, and springeth from
the same origin with the *Elevator* of the Eye, (a-
bove it) namely at the hole through which the
Optick Nerve passes into the orbit, and holds the
same course with it, being of the same Figure and
Substance, *viz.* fleshy, till at last parting from it,
with a pretty broad but thin Tendon, it is inserted
into the Cartilage of the upper Eye-lid, which it
serves to lift up, and so to open the Eye.

These, I say, are proper to the upper Eye-lids;
but the following belong to the lower as well as
upper.

They

And Semi-circulares.

They are called *Claudentes*, or shutters of the Eye-lids, as also *semicirculares*; (others call them *Circulares*, taking them for one.) They are placed between the *membrana carnosæ* and the inner Membrane of the Eye-lids that is extended from the *Perieranium*. That which draweth down or shutteth the upper, is the larger, and ariseth from the inner corner of the Eye and that part of the *Supercilium* that is next to the Nose, with a sharp beginning: from whence it passeth transversely toward the outward corner, growing presently fleshy and broader, so that it filleth up all the space betwixt the Eye-brow and the lowest edge of the Eye-lid on which the Hairs grow, (which is called *Cilium* or *Tarsus*) and at length is inserted into the outer corner. That which moveth the lower (though but obscurely) in order to shut it is less, being membranous and thin, arising from the side of the Nose with a sharp beginning as the other; whence being carried transversely it comes to the middle of the Eye-lid, where becoming something fleshy it continues its course to the outer corner which it turns about, and ascending to the upper Eye-lid is inserted into it with a broad end. These two Muscles being contracted shut the Eye, the greater drawing down the upper Eye-lid, and the less pulling up the lower. But the lower has no Muscle to pull it down again, seeing its own gravity and the relaxation of its Fibres is sufficient for that purpose: whereas the upper, as was observed before, has a peculiar Muscle to pull it up.

The Frontales.

Yea, besides the *Recti* aforesaid, there sometimes concur, when we would open our Eyes very wide, the *Musculi frontales*, or Muscles of the forehead, which spring from the Skull near the coronal future, and having their outer edge knit

the temporal Muscles, are contiguous to one another with their other side upon the middle of the fore-head, upon which they descend with streight Fibres to the Eye-brows, where they terminate. By the help of these we draw up and wrinkle the fore-head, and by consequence pull up the upper Eye-lid a little. The Skin grows very close to these Muscles.

Some describe another pair of Muscles of the Fore-head, called *Corrugantes*, whose Fibres descending a-slant from the lower part of the *Frons* betwixt the Eye-brows towards the top of the Nose, (where they meet one another) help to knit the Brows (as we call it) when we frown. But these seem to be onely a part of the frontal Muscles, having their Fibres running in this place a little obliquely. Corrugantes.

C H A P. IV.

Of the Muscles of the Eyes.

TH E Muscles of each Eye are in number six; *Each Eye* four *streight*, and two *oblique*. The *streight* have six move the Eyes upwards and downwards, to the right hand and to the left: the *oblique* move them obliquely. The *streight* are more thick and fleshy than the *oblique*. *Muscles.*

As to their beginning, (*viz.* of the *streight*) *Four* they have all the same origine; as to their progress, the same structure; and as to their end, the same insertion. Their *Origine* is contiguous and acute, being at the hole through which the optick Nerve enters the orbit of the Eye, from whose Membrane they spring. Their *middle*, or belly, *Their Rise and Insertion.*

belly, is fleshy and almost round. Their end is a most thin and membranous Tendon, whereby they are inserted into the *tunica cornea*, where it is pellucid, near the *Iris*, and so do encompass the whole Eye before as far as it is white.

The *first* of the *streight* is called *attollens* or *Elevator*, because it moveth the Eye upwards; and it is somewhat larger than the second that moveth the same downwards, because it requireth greater force to pull any thing upwards than downwards. This first is otherwise called *superbus*, because that motion of the Eye is owing to it, when we are said to look high. For which reason the *second* has the name of *humilis*, because by it we look down; whence also it is otherwise named *deprimens*. The *third* is called *adducens*, because it moveth the Eye inwards towards the Nose; as also *bibitorius*, because we are wont to use it to look into the glass or cup when we drink. The *fourth* is called *abducens*, from its drawing the Eye outwards from the inner corner to the outer; and also *indignatorius*, because that motion or call of the Eye (as we call it) is proper to Men in the Passion of Anger.

The first is placed in the upper region of the orbit, the second in the lower, (opposite to the upper) the third in the inner corner of the Eye, the fourth in the outer.

Two ob-
lique.
Their Rise
and Inser-
tion.

The *oblique* Muscles are called *circumagentes* winders or rollers about, and *amatorii*, or amorous; and are in number two. The *first* is *oblique major*, or *superior*, the upper and larger. This beginneth at the hole by which the Optick Nerve enters into the orbit of the Eye, as the four foregoing Pair did, and passing to the upper part of the inner corner of the Eye, endeth in a small and round Tendon, which passeth thro' a transvers cartilage

cartilage there placed, (called by *Fallopian Trochlea*) as a cord through a pulley, and is inserted into the upper side of the *Cornea*, betwixt the *attollens* and *abducens*. This seems to be a very considerable Muscle, seeing the fourth pair of Nerves (called *Nervi pathetici*) are wholly spent upon it, according to *Dr. Willis*. The second is *obliquus minor*, or *inferior*, the lower and smaller. This springeth from the lower and almost outer part of the orbit, (namely at the juncture of the first bone of the upper Jaw with the fourth) with a carnosus beginning. It is slender but not quite round, and passeth obliquely to the outer corner of the Eye, which having turned about, it ends in a short roundish and nervous Tendon, which meeteth with the Tendon of the other oblique Muscle, and is inserted obliquely near the *Iris* betwixt the Tendons of the *attollens* and *abducens*, with the other, so that both seem to have but one Tendon. This rolleth the Eye towards the Nose, as the other draweth it from it.

Before you shew the Muscles of the Eye, cut off the fat with your scissers, then shew first the *obliquus major*, then the *obliquus minor*, and last of all the four streight Muscles. Nevertheless let the *obliquus major* remain last, when all the rest are taken away, that you may shew how the Tendon of it passeth through the *Trochlea* or pulley the more plainly.

How these Muscles are to be shew'd.

Which *Trochlea* is thus described by *Spigelius*: *Trochlea* is a little round Cartilage, hollowed like a Pipe or piece of a straw, that is suspended by a Ligament in the outer corner of the Eye, through which the Tendon of the greater oblique Muscle passing, procures unto that Muscle the name of *Trochlearis*.

C H A P. V.

Of the Muscles of the Nose.

*The Nose
 hath four
 Pairs.*

TH E *Nose* is not all of it moveable, but only its lower gristly parts, which are called *Ala* or *Pinnae*. And these are either drawn together to shut the Nostrils, which is performed by the *adducent* Muscles; or drawn asunder to open the Nostrils, which is done by the *abducent*. And there are two Pair to serve each Office.

Before I enter upon the Description whereof I desire it may be noted, (once for all) that though all the Muscles of the Body be double (except the Sphincters) so that they are commonly reckoned by *Pairs*; yet in their Description we shall speak of them in the singular number, as if there were but one of a sort. Which method (after this advertisement) can occasion no mistake or inconvenience, seeing all the particulars that agree to one, agree to its fellow likewise.

Two abducent.

The first of the *abducent* or opening Muscles is small, rather Carnous than Membranous, arising from the upper Jaw-bone, near the first proper Muscle of the Lips, and is inserted partly into the lower part of the *Ala* of the Nose, and partly into the upper part of the upper Lip, by the dimple in its middle which is called *Philtrum*. The second covering the side of the Nose, begins at its base near the *foramen lachrymale*, with an acute and fleshy Origine, and descending obliquely by the bone of the Nose it ends in a broad Basis, and the remaining fleshy is implanted into the *Ala*. It is near of a three-square or triangular shape, like

the Greek Letter Δ *delta*, whence it is called by some *deltoides*. These two by drawing the *Ala* upward widen and open the Nostril.

The *adducent* or closing Muscles are very small Two adducent. ones, so that they can hardly be discovered or distinguish'd exactly but in them that have large Noses. The first of these is *external* and fleshy, rising about the root of the *Ala*, which it ascends, creeping transversely over it to the ridge or tip of the Nose, into which it is inserted. The second is *internal*, and is hid in the cavity of the Nostril under the inner coat that covers it: it is membranous, and arises from the extremity of the bone of the Nose, where the Cartilage is joined to it, and is inserted into the *Ala*. The former being contracted depresses the *Ala*; the latter draws it inwards, and so closes or constricts the Nostril. And to the same end or purpose there is another that serves, (which is common) namely the *orbicularis* of the upper Lip, which by drawing the Lip downwards, doth at the same time constrict the Nostrils.

Bartholin writes, that besides these Muscles, he has sometimes found a small carnosus Muscle reaching streight down from the frontal Muscle (with a broad Basis, but presently growing narrower) and ending about the Cartilage of the Nose. Such as have this Muscle can draw their Nose (especially its skin) a little upwards: which motion we use, when (as *Horace* speaks) *suspendimus aliquem naso*, we jeer or scoff at one.

C H A P. VI.

Of the Muscles of the Lips and Cheeks.

Muscles
common to
the Cheeks
and Lips.

1. Detra-
hens qua-
dratus.

THE Muscles of the Lips are either common to the Cheeks and Lips, or proper onely to the Lips.

The common are two on each side. The first is called *detrahens quadratus*: this is a thin but broad Muscle, resembling a Membrane interlaced with fleshy Fibres. It hath its beginning from the hinder side of the neck, the shoulder-blade, the *clavicula* and the breast-bone, and mounting up by oblique Fibres to the Face, is implanted into the Chin, Lips, and root of the Nose; which parts it draws obliquely downwards. Sometimes it proceeds also to the root of the Ear, and is reckoned for one of its Muscles. It is called *quadratus* or four-square from its shape. When a convulsion happens in this Muscle, it causes the *spasmus cynicus*, which we can imitate voluntarily by drawing down one side of the Mouth.

2. Contra-
hens.

The second is called *contrahens*, or *Buccinator* the Trumpeter. This lieth under the former, in the upper part of it. It makes up all that part of the Cheek which is distended in blowing hard. It springs from the Gums of the upper Jaw, and ends in those of the lower. Most Anatomists describe it to be of a round figure. It is thin and membranous, interlaced with divers Fibres, and is knit so close unto the Membrane which covereth the inside of the Mouth, that it can hardly be severed from it. This Muscle is not only of use to move the Cheeks with the Lips, but when it is contracted, it turneth in the meat upon the Teeth.

Teeth again, that had got to betwixt them and the Cheek, in chewing of it.

The Muscles *proper* to the Lips, are *five* Pair, *Muscles* and one odd one. The *First* is *par attollens*. If *proper to the Lips.* both of these act together, they draw all the upper Lip directly upwards and outwards; but if *1. Attollens.* onely one, then is but one side of the Lip drawn up obliquely. Each springeth from the first bone of the upper Jaw, where the Ball of the Cheek is. At its Rise it is broad and fleshy: from thence marching obliquely to the fore-part, it is inserted into the side of the upper Lip near to the Nose.

The *second* is called *abducens*, and assisteth the motion of the former, or rather draweth the upper Lip more to one side. It ariseth out of the Cavity that is under the Ball of the Cheek with a fleshy but slender and round beginning, and being covered with much Fat, it is implanted into the *frænum* where the Lips meet, at the corner of the Mouth. *2. Abducens.*

The *third* Pair is called by *Riolanus*, *Zugomati-* *3. Jugale.* *cum* or *Jugale*, because it arises outwardly from the Jugal Process. It is fleshy and round, and descending obliquely through the Cheek, is terminated near the corner of the Mouth, and serves to draw both Lips upwards side-ways; for it is common to them both.

The *fourth* Pair is the *deprimens*, which pulleth *4. Depri-* down the lower Lip. It springeth broad and fleshy *mens.* from the lower and fore-side of the Chin, from whence ascending obliquely, it is inserted into the middle of the under Lip, continuing broad from its Origine to its End.

The *fifth* Pair may be called *obliquè detrahens*, *5. Oblique* for it draws the lower Lip obliquely downwards *detrahens.* and outwards. It springs from the lower side of the lower Jaw with a fleshy and broad beginning,

(being sometimes extended to the middle of the Chin) from hence it goes upwards, and growing narrower by degrees it is inserted obliquely into the lower Lip near its corner. Some make but one of this and the immediately fore-going; as also one other of the second and third, but they are indeed distinct.

6. Constringens.

And these are all of them Pairs, one on each side: but this which follows is single, namely the *Orbicularis* or *Constringens*, and is common to both Lips. It is otherwise called *Osculatorius*, because it contracteth the Lips in Kissing. This is that which makes the proper figure and soft substance of both the Lips, encompassing the whole Mouth like a Sphincter, which by its orbicular Fibres it constringes or purses up when one is said to simmer. It is closely knit to the skin of the Lips, through which it looks red when we are well, and pale when we are sick. Some suppose this to be no Muscle, but a spongy sort of flesh, endued with no true muscular Fibres, viz. such as are capable of true muscular Contraction. But I think there is reason enough to acknowledge it for a true Sphincter Muscle, seeing the pursing up of the Mouth can be performed by none of the other Muscles that belong to the Lips.

CHAP. VII.

Of the Muscles of the lower Jaw.

THE lower Jaw (for the upper is immoveable, and therefore has no Muscles) is moved upwards, downwards, towards the right and left sides, and backwards. For the performance of these

these motions *five* Pair of Muscles are appointed, of which there is only one Pair that draweth the Jaw downwards, all the others in some measure upwards, but chiefly the first Pair or Temporal. The reason why there is so slender a provision for pulling the Jaw down is, because upon the relaxation onely of those Muscles that draw it up, its own gravity is sufficient to make it fall down; but yet that that motion may be performed the more quickly and nimbly in chewing or speaking, Nature has appointed one Pair of Muscles to promote it.

The lower Jaw hath five Pair of Muscles.

The first Pair of the Shuttters or drawers up is called *Temporale*, and is the strongest and largest. It springeth from the bones of the *Frons*, *Sinciput* and Temples, and from *Os sphenoides*, with a fleshy, large and semicircular beginning, and on its outer side is covered with the *Pericranium*, its inner lying next the *Periosteum*. Its Fibres, the further they are from its middle, the more obliquely are they carried towards its Tendon, for the further it descends, the narrower (but thicker and more carnosus) it grows; and at length passing under the *Os jugale*, it embraceth and is inserted into the thin and broad Process of the lower Jaw (called *rostrum*) with a short but very strong Tendon. *Spigelius* says, this Tendon is extended through the whole Muscle, in the midst of its fleshy substance. Whence it is, that if this Muscle be wounded, and inflamed, most bitter pains and dangerous symptoms ensue, partly because the Tendon passeth so; partly because it is covered with the *pericranium*. This Muscle forcibly pulleth up the lower Jaw, and so shutteth the Mouth.

1. Temporal.

Why the wounds of the temporal Muscle are dangerous.

The second is called *masseter*, because it serveth for chewing by moving the Jaw to the right and left sides: from its situation it may be called *lateral*.

2. Masseter or lateral.

rale. This hath two beginnings; one of which is nervous, large and strong, springing from the suture, where the first bone of the Jaw is joined to the fourth; the other fleshy, proceeding from the *Os jugale*, from whence marching towards the Chin, it is implanted into the whole breadth of the lower Jaw strongly. The Fibres of this Muscle, by reason of its two beginnings, cross one another; so that it does not only move the Jaw laterally, but backwards and forwards also: upon which account some esteem it a double Muscle.

3. Aliforme externum, or maxillam abducens. The third pair is called *pterygoideum* (or *aliforme*) *externum*, or *maxillam abducens*. This hath also a double beginning, partly nervous and partly fleshy; springing partly from the upper external sides of the wing-like process of the *os sphenoides*, partly from the rough and sharp line of the same bone. Whence marching down with streight Fibres, it becometh greater and thicker. And at length is inserted by a strong Tendon into the inside of the *condyloides* process of the lower Jaw, under the Tendon of the temporal Muscle. This moveth the Jaw forward, whereby the Teeth of the lower Jaw are made to stand further out than those of the upper.

4. Aliforme internum, or maxillam adducens. The fourth pair is termed *maxillam adducens* or *pterygoideum internum*. This draweth the Jaw towards its head, or backward. This, in the beginning being nervous, doth spring from the inner cavity of the wing-like process of the *os sphenoides*; then becoming fleshy, large and thick and marching down by a streight passage, it is inserted into the inner and hinder part of the lower Jaw by a nervous, broad and strong Tendon. Besides its more proper action of drawing the Jaw backwards, it also helps the temporal Muscle.

Muscle to draw it up, and so do the second and third pair in some measure, wherefore we rank all these four amongst the *Shutters*.

The *fifth* and last pair opens the Mouth by pulling down the Jaw, whence it is called *Depri-*
mens, and otherwise *digastricum* or *biventre*, be-
 cause it hath two bellies. Anatomists commonly reckon this for the second pair of the Movers of the lower Jaw; but seeing it has a distinct office from the other four, we have plac'd it last. It has its beginning from the *Styloides* process of the Temple-bone, where it is nervous and broad; and afterwards becoming fleshy, small and round, it passeth downwards, and in its middle where it cometh to the flexure of the lower Jaw-bone, it loseth its fleshy substance, and degenerates into a nervous and round Tendon; but by and by it becomes carnous again, and going along the inner side of the lower Jaw is inserted into its forepart under the Chin. It loseth its fleshy substance and becomes tendinous in its middle, that it may give way to the Jugular Vein ascending in that place. This Muscle, as hath been said, draws down the Jaw, in which action some think it is partly assisted by the *par quadratum* described in the foregoing Chapter.

s. Depri-
mens, or
biventre.

C H A P. VIII.

Of the Muscles of the Ear.

THE Ear consists of an *outer* and an *inner* part; and each has its proper Muscles.

The *outer* part is moved but very obscurely, because in Men the Muscles are exceeding small;
 so

The auricula hath
four Muscles.

so that *Galen* calls them, only lineaments or resemblances of Muscles. There are commonly reckoned four of them, which by their situation seem fit to move this outer part of the Ear (called *auricula* by *Spigelius*, to distinguish it from the inner part called *auris*) four manner of ways.

1. The first is called *attollens*. This arises at the outer edge of the frontal Muscle (where it is contiguous to the temporal) with a thin and membranous beginning; and in its descent lies upon the temporal Muscle, by degrees becoming narrower, and is inserted into the upper part of the Ear, which it moveth upwards and forwards.

2. The second is called *detrahens*. This ariseth broad and carnosus from the mammillary Process, and growing narrower is inserted into the root of the Cartilage of the Ear, sometimes by two, sometimes by three Tendons. It draweth the Ear upwards and backwards.

3. The third is called *adducens ad anteriora*, whereby the Ear is drawn forward and downward. This is but a particle of the *Musculus quadratus*, that pulleth down the Cheeks, described before, which ascending with its Fibres, is implanted into the root of the Ear.

4. The fourth is *abducens ad posteriora*, which draws the Ear backward. This hath its beginning in the back-part of the Head, from the Tunicles of the Muscles of the occiput, above the processus mammillaris, where it is narrow, but waxing broader it is carried downward transversely, and is inserted into the Ear behind. All these Muscles in Horses, Oxen and the like, are very large to what they are in Men, (yea they have more than these) whereby they can move their Ears more strongly and apparently, to shake off Flies or any thing that offends them.

Mon

Monf. du Verney only reckons two Muscles of the Auricle, the first of which, he says, is made up of certain carnous Fibres arising from that part of the *pericranium* that covers the Temporal Muscle, from whence descending in a streight line it inserts it self into the upper and back-part of the *Concha*. The second, he says, likewise consists of five or six carnous Fibres, that take their rise from the upper and foremost part of the process *Mastoides*, and descending obliquely for about an inch terminate at the middle of the *concha*.

In the inner part of the Ear (called *Auris*) there are three. The first is called *externus*. It is small, springing pretty broad from the upper part of the *meatus auditorius*; then becoming narrower it grows into a very fine and small Tendon, which being carried contiguous to the *tympanum*, is inserted into the longer process of the *malleus*. The handle of which *malleus* adhering to the *tympanum*, when the *malleus* is moved by this Muscle, the *tympanum* is so also, both of them being drawn a little outward and upward.

The second is called *internus*. This is very small, and is placed within the *os petrosum*. It hath its beginning in the *basis* of the wedge-like bone, where where it is joyned with the *processus petrosus*, and at about its middle it is divided into two small Tendons, whereof the one is inserted into the shorter process of the *malleus*, and the other into the neck or handle of it. This draws the head of the *malleus* obliquely forward, and pulls it inward from the *incus*, and together with the *malleus*, it draws the *tympanum* also inwards, to which the handle of the *malleus* is affixt.

These two du Verney reckons for Muscles of the *Malleus*, and he describes a third belonging to the *Stapes*, which (I think) no former Anatomist

The auris
three.

1.

2.

3.

tomist hath observed. He says, it is hid within a quill-like cavity formed in the *os petrosum* almost at the bottom of the barrel, from whence it takes its rise. Its belly is thick and carnosus, and in a little space it ends in a very loose Tendon, which inserts it self into the head of the *Stapes*. The cavity which contains the belly of the Muscle is about the sixth part of an inch long, and is much wider than the hole by which the Tendon of the Muscle passes.

CH A P. IX.

Of the Muscles of the Tongue.

THE Tongue being the chief Instrument of Speech, and a part which serves to roll the Meat in the Mouth this way and that way, has all manner of motions, being moved forward and backward, upward and downward, to the right hand and to the left; it is also stretched out broad, or contracted. Its Muscles are either proper to it self, or common to it with the *os hyoides* (to be described in the next Chapter.)

The Tongue
has five
pair.

1.

It has five pair of proper Muscles. The first is *genioglossum*, so called from its rise and insertion (*γένιον* the Chin, and *γλῶσσα* the Tongue) as most of the rest are. This pulleth the Tongue forward without the Teeth and Lips. It springs from that rough part of the lower Jaw-bone which is in the middle of the Chin, in the inner and lower side of it; and is inserted into the lower side, and towards the root of the Tongue.

The second is called *hyoglossum* (on the same account.) It arises from the middle and upper part of the *os hyoides* or *hyaloïdes*, and ends in the middle

middle of the Tongue, which it draws streight backwards or inwards.

The *third* is called *Myloglossum*. This springeth from the inner part of the lower Jaw, where the farthest grinding Teeth are, (whence it has its name) and is inserted into the Ligament by which the Tongue is tied to the fauces. Authors differ about the use of this pair; some thinking that it draws the Tongue downward; others, that if both of them act together, they draw the tip of the Tongue streight upward and backward to the Palate and upper Teeth; if but one, that it draws it obliquely upward towards its own side.

3.

The *fourth* is called *Ceratoglossum*, because it ariseth from the horn of the *Os hyoides*. It is inserted into the side of the Tongue. If both of these be contracted at once, they draw the Tongue streight downward and inward; but if only one, then is the Tongue drawn obliquely to that side.

4.

The *fifth* pair is called *Styloglossum*, because it ariseth from the *styloides processus* of the Temple-bone; from which springing fleshy and small, but afterwards becoming broader and thicker, it is inserted into the side of the Tongue, at about the middle of its length. If both these act together, they pull the Tongue upward and inward; but if one only, then to the right hand or to the left.

5.

CHAP. X.

Of the Muscles of the Bone of the Tongue, called Os Hyoides.

THIS Bone is moved upwards, downwards, forward, backward, and towards the sides, as the Tongue is; for seeing it is fixed to the root

of

of the Tongue, they must needs accompany one the other in their motions; so that the Muscles that are inserted into this bone, moving the Tongue also, they are esteemed *common* to both.

Os hyoides hath four pair.

1.

To perform these motions it hath four pair of Muscles. The first is called *Sternohyoideum*. This springing from the upper, but inner part of the *Sternum* with a broad and carnous beginning, and ascending under the Skin of the Neck by the Wind-pipe, still keeping the same largeness and substance is inserted in the root or *basis* of the *hyoides*, which it moveth (and the Tongue with it) downward and backward.

2.

The second is opposite to this, and is called *geniobyoides*. This springing from the inner part of the Chin, (by the *genioglossum*) fleshy and broad, is inserted into the upper part of the *basis* of the Bone, where a cavity is made to receive its Tendon, and draweth it streight upwards and a little forwards.

3.

The third is called *Coracohyoideum*. It ariseth from the upper side of the *Scapula* near the *Coracoides processus*, having a carnous beginning, and lurking under the *Levator* of the Shoulder-blade called *Musculus patientia*, it ascends under the *par mastoides* that bends the Head, where it loseth its fleshy substance, and degenerates into a nervous and round Tendon. But as soon as it is past this it becomes carnous again, and so continues till it is inserted into the horns of the *Os hyoides*. Considering its slenderness it is the longest Muscle of the Body, and has two Bellies like the *par depressor* that pull down the lower Jaw. The reason of its becoming tendinous in the middle, *Spigelius* thinks to be, that it may make way for the *par mastoides*, as being more worthy than it self: but *Dr. Croone* is of opinion, that the reason is, that

it may give way to the *Carotides* ascending under it. Its office is to pull the Bone obliquely downwards.

The fourth is *styloceratohyoideum*. This riseth from the root of the *processus styloides*, and endeth in the root of the horn of the *Os hyoides*, which it draweth obliquely upward.

C H A P. XI.

Of the Muscles of the Larynx.

THE *Larynx* consists of four Cartilages (besides the *Epiglottis*) of which we have treated in Book II. Chap. 14. Of these only three are moveable, viz. the *Thyreoides* or Buckler-like, which is one, and the *Arytanoides* or Ewer-like which are two. By these latter is the *Rimula* of the *Glottis* formed, for the widening and straitening, or opening and shutting whereof the Muscles of the *Larynx* serve. These are divided into *common* and *proper*. The common spring from other parts, but are inserted into one of the Cartilages; the proper both arise from and are inserted into them. The *common* are two pair, viz. *hyothyreoideum* and *sternothyreoideum*.

The Larynx hath two pair of common Muscles.

The *Hyothyreoideum* springeth from the whole basis almost of the Bone of the Tongue, having a broad and carnosus beginning; from whence descending with streight Fibres, and covering all the outside of the Cartilage *Thyreoides*, it is inserted into its under-side. When this is contracted, it draws the buckler-like (or *thyreoides*) Cartilage upwards and inwards, and thereby straiteneth the Chink of the *Larynx*.

The

2. The *Sternothyroideum* ariseth from the upper and inner-part of the *sternum* with a carnous and broad beginning, from whence ascending with streight Fibres up by the sides of the Wind-pipe, (continuing the same largeness and substance) it is at last inserted into the lower side of the backler-like Cartilage, by drawing down which it opens or widens the Chink. *Diemerbroeck* assigns clear contrary actions to these Muscles, viz. that the former widens, and this latter straitens the *Rimula* of the *Larynx*.

Five pair
of proper.

1.

The *proper* are five pair, (or only nine Muscles, as some reckon, esteeming the fifth pair to be a single Muscle.) The first pair is called *Cricothyroideum anticum*. This springeth from the fore-part of the *Cricoides* or ring-like Cartilage, (viz. that which is immoveable) and is inserted into the lateral parts of the *Thyreoides*, which it moves forwards, and so widens the *Rimula*, for the forming of a big voice. *Bartholin*, from the insertion of the Nerve, says, it arises from the *Thyreoides*, and is inserted into the *Cricoides*. Also if this pair be very broad, he says, it may be divided into two pair, (which *Riolanus* has done) and then the second may be called *Cricothyroideum laterale*.

2.

The second pair, which is called *Cricoarthyroideum posticum*, springeth carnous from the hinder and lower part of the *Cricoides*, and ascending with streight Fibres is inserted with a nervous end into the lower side of the *Arytenoides*, serving to pull its two Cartilages sideways, and thereby to open and widen the *Larynx*.

3.

The third is *Cricoarthyroideum laterale*, which springeth from the side of the *Cricoides*, where it is broadest, with a slender beginning, but growing presently larger, it is implanted into the side

of the *Arytenoides*, in that part that the foregoing did not cover. This openeth the *Larynx* by drawing the Cartilages obliquely aside, and so assisteth the action of the former.

The *fourth* pair is called *Thyreoharytenoideum*. This is internal, carnous and broad, arising from the fore interior part of the *Thyreoides*, and is inserted into the side of the *Arytenoides*, whose cartilages it draws the one towards the other, and so straitens the *Larynx*.

4.

The *fifth* and last is reckoned by some for a pair, and by others but for one Muscle. It is called *Arytenoides*, because it has its rise from and insertion into the Cartilage so called. Its rise is at the hinder Line of the Cartilage, from whence being extended with transverse Fibres, it is inserted into the side of the same, and by constringing of it straitens the *Larynx*.

5.

These are the Muscles that perform the motions of the *Larynx*; but as to the use of each particular, Authors disagree very much. Dr. Croone gives this general rule to understand their uses, That those which lie on the fore-side of the *Larynx*, serve to open or widen the *Rimula*; and those which lie on the hinder-side, to straiten or shut it. To whose Opinion great deference is owing.

As for the *Epiglottis*, which is reckoned for the fifth Cartilage of the *Larynx*, though in some crutes it have Muscles, yet Anatomists generally agree that in Man it has none, nor is moved with voluntary motion, but is only depressed by the weight of what is swallowed, and by the drawing of the Tongue backward or inwards; which motion being over, the *Epiglottis* stands up again in its natural and proper posture, and so opens the *Larynx*.

C H A P. XII.

*Of the Muscles of the Uvula, Palate
and Throat.*

*The Uvula
said to have
two Pair of
Muscles.*

THE *Uvula* is said by *Veslingius*, *Riolanus* &c. to have two Pair of Muscles to hold it up; of which one is called *Pterygostaphilinum externum*, which springeth from the upper Jaw, a little below the furthestmost Grinder, and is inserted into the side of the *Uvula*: the other *Pterygostaphilinum internum* proceeding from the lower part of the internal wing of the *pterygoideus Processus*, and inserted into the *Uvula* in like manner. But these Muscles are very hard to discover: and indeed there seems no occasion for them, seeing the *Uvula* has no apparent motion, and its own frame seems sufficient to suspend it.

*The Palate
hath one
Pair.*

From the afore said wing-like Process (of the *Os cuneiforme*) does there another Pair of Muscles arise, first found out by Dr. *Croone*, and by him called *Pterygopalatinum*. Its Insertion is into the Roof of the Mouth by the side of the palatine Gland (described in Book III. Chap. ult. from *Steno*.) Its Use is very obscure; but perhaps in strong hawking it may serve to compress the said Gland a little, and to squeeze out of it some of that humour that is separated in it.

*The Throat
hath three
Pair and a
Sphincter.*

The *Throat*, or the beginning of the *oesophagus* called *pharynx*, hath seven Muscles, to wit, three Pair and a *Sphincter*.

1.

Of the Pairs, the first is *Sphenopharyngeus*. This springeth from the sharp point of the *Ossis sphenoides* with a small and nervous beginning and passing downward, ends in a fine Tendon which

which is inserted obliquely into the lateral part of the Palate and *Pharynx*, which it widens in swallowing.

The second pair is called *Cephalopharyngæum*, and springeth from that part where the Head is joyned to the first *Vertebra* of the Neck; from whence marching down, it is spread about the *Pharynx* with a large *plexus* of Fibres, and seemeth to make its Membrane. This straitens the Throat in swallowing.

The third is *Stylopharyngæum*. This springing from the *Styloides* Process of the Temple-bone, is inserted into the sides of the *Pharynx* to dilate it.

That Muscle which hath no fellow is called *Oesophagiæus*. This arises from one side of the *Thyreoides* Cartilage, and circularly encompassing the *Pharynx* with transverse Fibres, is inserted into the other side of the *Thyreoides*; and serves to contract the Mouth of the Gullet, as the *Sphincters* of the *Anus* and Bladder do those parts.

CH A P. XIII.

Of the Muscles of the Head.

THE Muscles of the Head are either common, or proper. The common are those which move the Head together with the Neck, which are to be described in the next Chapter.

The proper are those which only move the Head, the Neck remaining unmoved, and these are eight in number sixteen, or eight pair, and move it either

either forward or backward, to one side or the other, or about.

1. The *first* pair, called *Mastoideum*, bend the Head forward, if both act together; but on one side obliquely, if but one. These have each a double beginning; one nervous from the top of the *Sternum*, the other carnous from the upper side of the *Clavicula*; which origins joyning, it becomes wholly carnous, and ascending obliquely by the Neck, at last is inserted with a carnous end into the Mammillary (or *mastoides*) process of the Temple-bone. This is the only pair that is placed in the forepart, and bows the Head forward; all the rest are seated behind, of which the five next bend it backwards if both act (which is called extending of the Head) or a little sideways if but one; and the two last serve to turn it about.

2. The *second* pair is called *Splenium* or *Triangularis*. It rises with a nervous beginning from the Spines of the five uppermost *Vertebrae* of the *Thorax*, and of the five lowermost of the Neck from whence ascending and becoming thick and carnous, it is implanted into the *Occiput* with a broad and fleshy end.

3. The *third* is called *Complexum* or *Trigeminus* because it has so plainly a *threefold* beginning, that it seems to be a compound of three Muscles. One beginning is from the transverse Processes of the fourth and fifth *Vertebrae* of the *Thorax*, a second from those of the first and second of the Neck, and a *third* from the Spine of the seventh *Vertebra* of the Neck: All which in their ascent being united into one, are inserted into the *Occiput* sometimes by one, and sometimes by a triple Tendon.

The *fourth* pair is called *Parvum & crassum*, 4.
because it is but a *little* one, yet pretty *thick*. This
lieth under the third pair. It arises nervous from
the transverse Processes of the six uppermost *Ver-*
tebrae of the Neck, and is inserted into the hin-
der root of the Mammillary Process.

The *fifth* pair is *Rectum majus*. These spring- 5.
ing from the tip of the Spine of the second *Ver-*
tebra of the Neck, are inserted into the *Oc-*
ciput.

The *sixth*, *Rectum minus*. These lie under the 6.
former, and proceeding from the back-part of the
first *Vertebra* end into the *Occiput*.

These five last serve all to bow the Head back-
ward or extend it: the two following turn it
about, as was observed before.

The *seventh* is *Obliquum superius*. This pair lies 7.
under the two *Recta*, answering to them in sub-
stance and form. It springs from the transverse
Process of the first *Vertebra* of the Neck, and is
implanted into the *Occiput* by the outer-side of the
Recta. Some say its rise is here, and its insertion
into the *Vertebra*.

The *eighth*, *Obliquum inferius*. This rises from 8.
the Spine of the second *Vertebra* of the Neck, and
is inserted into the transverse Process of the first
Vertebra of the same. So that having both its rise
and insertion in the Neck, it might justly be reck-
oned for a Muscle thereof, and so should have
been described in the next Chapter: but we have
ranked it amongst those of the Head, partly
from the authority of most Anatomists who ge-
nerally have done so, and partly because the first
Vertebra into which it is inserted, always follows
the motion of the Head, as shall be shewn in the
next Book, Chap. 10. Of the use of these two last
pairs we have spoken already.

C H A P. XIV.

Of the Muscles of the Neck.

The muscles common to the head and neck are four pair.

THE Head is not only moved by the proper Muscles abovesaid primarily, but secondarily also by these of the Neck, which are therefore called *common*, and are eight in number, on each side four. The first and second pair bend the Neck, and together with it the Head directly backward, or obliquely; the third and fourth directly forward, or to one side, as both or one act.

1. The first is called *Spinatum*. This proceeding from the roots of the *Spinæ* of the seven upper *Vertebrae* of the *Thorax*, and of the five lowest of the Neck, is inserted strongly into the whole lower side of the Spine of the second *Vertebra* of the Neck.

2. The second, *Transversale*. This rising from the transverse Processes of the six upper *Vertebrae* of the *Thorax*, is inserted into the out-side of all the transverse Processes of the *Vertebrae* of the Neck.

3. The third, *Longum*. This being placed behind the *Oesophagus*, doth spring from the bodies of the fifth and sixth *Vertebrae* of the *Thorax*, and as it ascends is knit to the sides of the bodies of all the *Vertebrae*, till it come to the first or highest of the Neck, where each touching other they are both inserted into its Process, which answers to the body of the other *Vertebrae*.

4. The fourth, *Triangulare*, or *Scalenum*. It proceeds carnosus from the first rib, and is inserted into the inside of all the transverse Processes of the

the Neck, except sometime the first and second. It is perforated to make way for the Veins and Arteries which pass to the Arms. The uses of all these pairs were shewn at the beginning of the Chapter.

CHAP. XV.

Of the Muscles of the Thorax.

HAVING done with the Muscles that belong to the Head, the highest *Venter*, we come now to those of the middle or *Thorax* which assist Respiration. Of these some dilate the Breast in Inspiration, some contract it in Expiration.

Of the *Dilaters*, the first is called *par Subclavium*. The Dilaters. This ariseth fleshy from the inside of the *Clavicula* near the Shoulder-point, and passing obliquely (or almost transversely) is inserted into the first Rib, near to the *Sternum*.

The second is *Serratum majus anticum*. This arises from the inside of the *basis* of the Shoulder-blade, and the two uppermost true Ribs, and is inserted into the five lowest true Ribs, and two uppermost bastard Ribs, before they end into Cartilages. It is called *Serratum* or Saw-like, because its unequal extremities being intermixed with the like unequal beginnings of the obliquely descending Muscle of the *Abdomen*, imitate the Teeth of a Saw.

The third is *Serratum posticum superius*. This lying under the *Rhomboides*, (or fourth Muscle of the *Scapula*) springeth membranous from the Spines of the three lowest *Vertebrae* of the Neck.

1. 1. 1.

and

and of the first *Vertebra* of the Back, and is inserted into the three or four uppermost Ribs.

4. The fourth is *Serratum posticum inferius*. This ariseth from the Spines of the three lowest *Vertebrae* of the Back, and of the first of the Loins, and is inserted into three or four of the lowest (short) Ribs.

5. Fifthly, The eleven external *Intercostals*, which perform the office but of one Muscle. These spring from the lower part of the upper Rib, and are inserted into the upper part of the lower Rib obliquely.

There is another Muscle besides these that assists the widening of the Breast, namely the *Diaphragm*: but of it we spoke at large in Book II. Chap. 3. where the Reader may find its Description and Use.

The Con-
tractors.

1.

These that follow *contract* the Breast. First, the *par triangulare*. This arising from the middle Line of the *Sternum*, is inserted into the bony ends of the third, fourth, fifth and sixth true Ribs, (where they are joyned to the Cartilages.) *Stenon* says, its rise is from the *Sternum*, and insertion into the Ribs.

2.

The second is *Sacrolumbum*. This ariseth from the edge of *os ileum*, the upper part of *os sacrum*, and the Spines of the *vertebrae* of the Loins; and ascending up to the Ribs, is implanted into each of them in their lower side, about three Fingers breadth from the Spine, by a particular Tendon. *Diemerbroeck* describes another pair opposite to this (which he calls *cervicale descendens*) springing from the third, fourth, fifth, sixth and seventh *vertebrae* of the Neck, and is inserted into the upper side of each Rib as the *Sacrolumbum* is into the lower. And says, that this pair by pulling the Ribs upwards in inspiration widens the Breast.

as the other by drawing them down in expiration straitens it.

Thirdly, *The eleven internal Intercostals*, which are as one Muscle. These pass obliquely from the lower to the upper Rib. Their Fibres run a contrary course to those of the external, crossing of them like the strokes of the Letter X. 3.

I place the *Internal Intercostals* among the *Contractors* of the Breast, as also the *External* among the *Dilators*, because most Anatomists have done so; though some there are that think the internal dilate it, and the external contract it. Yea, Dr. *Mayow* is of opinion, that they both of them dilate it. For going upon this supposition, That the *Thorax* is widened by drawing the Ribs upward, he thinks them both equally adapted for that action. For seeing in all muscular motion the part that is less firm, is moved towards that which is more firm, and that each lower Rib successively is joyned looser than that immediately above it, it must needs be, that the internal upon their contraction draw the Ribs upwards as well as the external, and that not obliquely, but directly. For by their crossing one another they hinder the *obliquity* of one anothers motion (for which each severally is fitted) and so perform the same motion as if their Fibres descended straight from the upper Rib to the lower; which course of Fibres was not convenient here, because of the small space betwixt one Rib and another, which would not permit them to have that length which the nature of Muscles requires.] Thus that ingenious person discourses, I think, very probably.

These Muscles of Respiration are much assisted in their action, secondarily, by the Muscles of the *Abdomen*, *Scapula* and *Arms*, which shall be described in their proper Chapters.

C H A P. XVI.

Of the Muscles of the Back and Loins.

The back
and loins
have four
pair.

THE *Back*, but especially the *Loins*, being moved diversly, viz. backward and forward and to the sides, into every *Vertebra* there are Tendons of Muscles inserted, as if there were a great many Muscles in all. But there are but four (proper) pair to assist the motion of both.

1.

The first pair are two triangular Muscles, which being joyned together make a kind of a quadrature, and are therefore called *par quadratum*. These arise broad and thick from the hinder upper cavity of *Os Ileum*, and the inner side of *Sacrum*, and are inserted into the transverse Processes of the *Vertebrae* of the *Loins* even up to the lowest Rib. If both these act together, they bow the *Vertebrae* of the *Loins* streight forward; if one alone, obliquely forward.

2.

The second and principal pair are the *Musculi longissimi*. This springs from all the Spines of *Sacrum* and of the *Vertebrae* of the *Loins*, and also from the inside of *Os Ileum* where it is joyned to the *Sacrum*; from whence it ascends all up the Spine, and terminates in the *processus mammillaris* of the Temple-bone, in its way lying upon the transverse processes of the Lumbar *Vertebrae* and bestowing Tendons on the transverse Processes of all the *Vertebrae* of the Back, (whence some have divided this Muscle into as many as there are *Vertebrae*.) It is almost confounded with the two following from its rise till the lowest *Vertebrae* of the *Thorax*, where it begins to be separa-

ted

ted from them and leaves them. But so far as they accompany it, it is so very difficult to separate and distinguish them, that some account all three but for one.

The *third* pair are the Muscles called *Sacri*. This arises behind from the *Os sacrum*, with an acute and fleshy beginning, and ends in the Spine of the lowest *Vertebra* of the *Thorax*, and for the most part also is inserted, by the way, into the Spines and oblique Processes of the *Vertebra* of the Loins. This helpeth the action of the former.

The *fourth* and last pair are the *Semispinati*. This springs by a nervous beginning from all the Spines of *Os sacrum* and the Loins, and ends in the transverse Processes of the *vertebrae* of the Loins, and of the lowermost of the *Thorax*. *Spi-gelius* says, it arises from the Spine of the lowest *vertebra* of the Back, and ends in the Spine of the first; by the way bestowing Tendons on all the Spines, as the *Longissimi* did on the transverse processes. Others describe it otherwise. The truth is, it is so almost impossible to separate and raise these Muscles of the Back and Loins, that 'tis no wonder Authors differ so much in their number and description.

But how many soever they be, or wheresoever be their rise and insertion, the use of them all is to erect the Trunk of the Body by bending the Back and Loins backward, except the first pair which bow it forward, in which action they are much assisted by the *Recti* of the *Abdomen*, which we shall describe in the next Chapter.

C H A P. XVII.

Of the Muscles of the Abdomen.

IN the first *Book*, Chap. 3. where we discoursed of the common containing parts of the *Abdomen*, or lowest Venter, we only barely mentioned its Muscles, deferring the description of them till this place, where it seems more proper.

The Abdomen hath five pair.

I.

The *Abdomen* then hath ten Muscles, five on each side. The first pair is *Obliquè descendens*. It springeth from the lower side of the sixth, seventh, eighth, ninth, tenth, and eleventh Ribs, (before they pass into Cartilages) by so many distinct acute beginnings: and each presently spreading it self, in a short space they grow into one Muscle. These several beginnings appear somewhat like the Teeth of a Saw, and are intermixed with the Saw-like Tendons of the *Serratus major anticus* of the *Thorax*, as when one thrusts the Fingers of one Hand betwixt those of the other. Besides these origins, it is said also to spring from the transverse Processes of the Lumbar *vertebrae*: but Dr *Croone* thinks that to be a mistake, because those Processes are so covered with other Muscles, especially with the *Latissimus dorsi*, that this can by no means spring therefrom. Wherefore he assigns to it in this place another origin, namely from the investing Membrane of the said *latissimus*, as he does also to the following pair, who have been also said to arise from the said Processes. Lastly, it springs from the upper edge of *Os Ileum*; from all which places its Fibres descend obliquely forward, and it endeth by a broad Tendon in the middle of the Belly in the *Linea*
alba;

alba; which Tendon cleaves so fast to that of the obliquely ascending (lying next under this) that they cannot be separated without tearing. The *Linea alba* in which these Tendons end, is a white *Linea alba* part or Line running from the *Mucronata cartilago* at the pit of the Stomach, down the middle of the Belly by the Navel to the *Ossa pubis*, and is made of the concurrence of the Tendons of the Muscles of the *Abdomen*; namely of this pair already mentioned, and of the *Obliquè ascendens*, the transverse and pyramidal.

The *second* is the *Obliquè ascendens*. This lies 2. next under the former, and its Fibres ascending obliquely cross those of the other like an X. It springs from the transverse processes of the *vertebra* of the Loins, (as hath hitherto been taught, but Dr. Croone says, from the investing Membrane of the *latissimus dorsi*) and the Spines of *Os sacrum* with a membranous beginning, and from the edge of *Os Ileum* with a fleshy. Ascending carnosus from hence it is joyned to the Cartilages of the eighth, ninth, tenth and eleventh Ribs, and ends in the *linea alba* with a broad and nervous Tendon.

Note, That the Tendons of both these oblique Muscles, (as also those of the transverse) are perforated in the bottom of the *Abdomen* for the descent of the Spermatick vessels into the *Scrotum*.

The *third* pair is the *Rectum* or streight. This 3. arises fleshy from the lower part of the *Sternum*, from the side of the *Cartilago mucronata*, and from the Cartilaginous ending of four Ribs; and so marching streight down along the Belly, it is inserted by a strong Tendon into the *Os pubis*. It hath sometimes three, sometimes four transverse inscriptions or intersections, that appear tendinous :

nous: whence some divide each Muscle into four or five Muscles, accordingly as they have three or four intersections. And indeed if *Galen's* Rule be true, that wheresoever the Nerve is inserted into the Muscle, *there* is its head: we must confess they are distinct Muscles. For Nerves are inserted into both their upper and lower parts, and into each of those that lye betwixt the Intersections. And by supposing them thus distinct, we may conceive how they may better perform their primary action, which is strongly to compress the Belly for the expulsion of the *fœces* or *fœtus*. Under these Muscles do the *Arteriæ* and *Venæ mammariæ* descend to about the Navel, as the *Arteriæ* and *Venæ epigastricæ* ascend under them to near the same place; and these were held to inosculate one with another (the descending with the ascending) till of late that such inosculature is discovered to be merely imaginary.

4. The *fourth* pair is the *pyramidal*. These Muscles are seated upon the lower part of the *Recti* springing carnos from the *Ossa pubis* into which the *Recti* are inserted. They are broader at their *basis*, and in their ascent grow narrower and narrower till they end in an acute Tendon, which is inserted into the *linea alba*, and reaches sometimes as high as the Navel, though their carnos part be but about an hands breadth long. They are said to assist the *Recti* in their action, and are for that reason called otherwise *Succenturiati*. But they seem to some more particularly to serve to compress the Bladder in making Water; though considering the shortness of their carnos part and their external situation, 'tis difficult to conceive how they can much assist that action, which most probably is chiefly performed by the

pro-

proper muscular Fibres of the Bladder it self, but perhaps may be somewhat promoted by all the Muscles of the *Abdomen* as well as this, while they constrict the Belly and so press the Guts against the Bladder; which pressure is remotely owing also to the Muscles of the *Thorax*, especially the Diaphragm. Sometimes one, and sometimes both of these pyramidal Muscles are wanting, and then the ending of the *Recti* is broader and more car-nous.

The fifth pair is the *transverse*. These cleave close to the *Peritonæum* on their inside: and they are called *transverse*, because their Fibres run cross or athwart the Belly. They spring from a Ligament that grows from the transverse processes of the *vertebræ* of the Loins, from *os Ileum*, and the inside of the cartilaginous ends of the bastard Ribs, and end in a broad and membranous Tendon in the *linea alba*.

5.

The use of all these Muscles hath been held to be first, when they act not, to defend the viscera contained under them from external injuries, and to encrease their heat: and secondly, when they are in action, first to further the excretion of the Excrements; secondly, to help the exclusion of the Infant in labour; thirdly, to assist the Breast in strong expiration and expectoration; and fourthly, to help to bend the Trunk of the Body forward in stooping, which is chiefly done by the *Recti*. But *Diemerbroeck* thinks that the streight, pyramidal and transverse are all that serve for the compression of the Belly, and that the oblique do elevate or dilate it. And he endeavours to prove this to be their action; first, because there will be no Muscles to elevate the parts of the *Abdomen*, if these do it not; whereas it is both evident to every one's own observation in himself, that the

Their use.
Abdomen.

Abdomen is alternately elevated & deprest, and also such an alternate elevation and depression seems necessary for the furthering the motion of the Aliments and Humours through the parts contained in the lower Belly. *Secondly*, he appeals to their oblique situation, which is inconvenient for pressing. *Thirdly*, he thinks their rise and the length of their Tendons evince, that their use is not to compress. For he says, when their fleshy part grows tumid, they draw the Tendons with the *linea alba* outwards, and elevate them; and that this Intumescence ordinarily concurs with that of the Muscles that dilate the Breast. *Casp. Bartholin* believes the transverse chiefly conspire with the Diaphragm to respiration. For demonstrating that the Diaphragm is a digastrick or double-bellied Muscle, the nervous centre being the Tendon intervening between the two Bellies he has observed further (in Oxen) that the fore part of the Diaphragm extends a particular Tendon to the end of each of the *costæ nothæ*, where to the upper part of these transverse Muscle firmly also adheres; and so he supposes that there is a continuation of the one into the other the two bellies of the Diaphragm, and the transverse Muscles making on each side a trigastrick one. And upon this supposition he is of opinion "That seeing in inspiration, wherein the Breast is to be dilated, the Ribs ought to be drawn upward, at which time also the flesh of the said trigastrick Muscle is relaxed, and the Diaphragm, being from bowed become more plane and relaxed, and thrust toward the *Abdomen*, permits the Ribs to be a little lift up and elonged for the dilatation of the Breast; which when at length it is contracted by the fleshy Fibres of this trigastrick Muscle, the Ribs re-

"turn to their former Angles with the *Vertebra*,
 "and the contracted Fibres of the Diaphragm
 "from plane becoming bowed, do ascend up
 "further into the cavity of the Breast, which,
 "by depressing the *Sternum* also, they straiten,
 "and so cause the Air to be expelled out of the
 "Lungs.] So that he makes the chief Use of
 the transverse Muscles to be to assist Expi-
 ration.

C H A P. XVIII.

Of the Muscles of the Genitals, both in Men and Women.

I N the First Book, Chap. 23. *Of the Yard*, we
 described its Muscles and their Action, whi-
 ther the Reader may please to turn, and here we
 shall but just name them. They are two Pair. The *The Penis*
 first are the *Erectores* or *Directores*, which arise *hath two*
 from the inner knob of the *Coxendix*, and are in- *Pair.*
 serted into the nervous bodies of the *Penis*, near
 their beginning. The second are the *Acceleratores*,
 which arise from the *Sphincter* of the *Anus*, and
 passing on the under side of the *Penis* (by the sides
 of the *Urethra*) end about its middle.

The *Clitoris* in Women, (something resem- *The Clito-*
 bling the *Penis* in Men) hath also two Pair of Mus- *ris hath also*
 cles, which having described Book I. Chap. 29. we *two Pair.*
 shall not insist on here, but remit the Reader
 thither.

As to the *Cremaster* Muscles by which the *Te-*
stes are suspended in Men, see them described
 Book I. Chap. 31. As for Womens *Testes*, they
 have no *Cremasters*.

C H A P. XIX.

Of the Muscles of the Bladder and Anus.

THE Bladder, as was shewn in the First Book Chap. 19. consists of three Membranes whereof the middle is muscular, being endued with carnous Fibres; yea by *Spigelius* it is reckoned for a *Muscle*, and called *Detrusor Urinae*. But in the above-mentioned place we have described it under the notion of a *Membrane*; and what is there said of it may suffice, unless we would enter upon a Controversie of Names.

The Bladder hath but one Muscle.

Excluding that Membrane therefore from the number of *Muscles*, the Bladder will have but one, namely, its *Sphincter*, which encompasses its Neck, (and environs the Prostates also.) In Men it is about two inches broad, and is generally esteemed to be nothing else but the middle Membrane here grown more carnous than in the rest of the Bladder. Its Fibres are orbicular, and by the contraction of them is the Neck of the Bladder constringed or pursed up, so that the Urine cannot pass out unless they be voluntarily relaxed, or rather unless when they are overpowered by the contraction and compression of the Muscular Membrane, &c. for then they are forced to give way to the Urine. In Women it is not so broad, because the Neck of their Bladder is shorter, but it reaches to the hole by which the Urine passeth into the *Vagina Uteri*, and seemeth to form it.

The Anus sheweth three.

The *Anus* hath three Muscles. The first is the *Sphincter Ani*. This is fleshy, and encompasses the end of the streight Gut, being two inches broad.

broad. Its Fibres are orbicular. It doth not spring from any adjacent Bone, but onely adheres to the *Coccyx*. It serves to purse up the Fundament, and so hinders the involuntary Evacuation of the *Faces*. The *second* and *third* are called *Levatores*. These spring from the inside of the Ligaments of the *Coxendix* and *Os sacrum*, being broad and membranous, from whence passing by the sides of the streight Gut, they stick to it, and are inserted into the upper part of the *Sphincter*. These draw up the Fundament again after it is made to strut out in straining to stool; yea they prevent its falling out, which sometimes happens upon their violation.

C H A P. XX.

Of the Muscles of the Scapula or Shoulder-blade.

THUS we have done with the Muscles of all the three *Venters*: now we come to those of the *Limbs*. And first of the *Scapula* or *Shoulder-blade*.

It is moved forward, backward, upward and downward, and for the performance of these motions hath four proper Muscles. The *first* is called *Trapezius*, as also *Cucullaris*, because it with its fellow covering the Back resembles a Monk's Cowl. It ariseth fleshy from the lower part of the *Occiput* towards the Ear; but from the posterior Processes or Spines of the five lowest *Vertebrae* of the Neck, and of the eight uppermost of the *Thorax* it springeth membranous. Being thus broad at its Rise, it grows narrower in its Progress, and is in-

Each Scapula hath four Muscles.

1.

M m 2

serted

ferted into the whole Spine of the *Scapula*, into the Shoulder-point, and broader part of the *Clavicula*. Now through its large beginning and indifferent narrow Tendon or End, it comes to pass that its fibres hold a various course; some of them being *streight*, others *obliquely descending*, and others *obliquely ascending*. Whence it is also that it performs divers offices; for it draws the *Scapula* directly backwards by its *streight* Fibres, (which spring from about the first and second *Vertebra* of the *Thorax*;) obliquely downwards, by the obliquely ascending, (which arise *below* the *streight*;) and obliquely upwards, by the obliquely descending, (which arise *above* the *streight*.)

2. The second is *Levator*, or *patientie Musculus*, so called from its helping to shrug up the Shoulders; when we would intimate that there is no Remedy but *Patience*. This hath its beginning from the transverse Processes of the first, second, third and fourth *Vertebra* of the Neck; which beginnings being united about the middle of the length of the Muscle, it is at length inserted by a broad and carnos Tendon into the upper corner of the Shoulder-blade, which it draws upward, and (as Authors say) somewhat forward.

3. The third is *Serratus minor anticus*. This lies under the Pectoral Muscle, and springs from the four uppermost Ribs (except the first) before they become cartilaginous, by four fleshy portions representing the Teeth of a Saw, and is inserted by a broad Tendon near to the Anchor-like Process of the *Scapula*, which it draws forward towards the Breast.

4. The fourth from its Figure is called *Rhomboides*. This is placed immediately under the *Cucullaris*. It springeth fleshy from the hinder Processes or Spines of the three lowest *Vertebra* of the Neck

and so many uppermost of the *Thorax*, and is inserted by as broad a fleshy ending, as the beginning was, into the *Basis* of the Shoulder-blade, which it draws backward.

Besides these four proper Muscles it hath others that are common to it with other Parts; which in some measure assist its Motions, as the *Serratus major*, described above, Chap. 15. and the *Deltoides*, which we shall describe in the next Chapter.

C H A P. XXI.

Of the Muscles of the Arm.

THE *Arm* in common acceptation is meant of all the distance betwixt the Shoulder-point or Neck of the Shoulder-blade, and the Wrist; but we take it more strictly here for that part onely that reaches from the Shoulder to the Elbow, (which it self is otherwise called *humerus*) and consists of one bone, which we shall call the *Shoulder-bone*. It hath five motions, for it is moved backward, forward, upward, downward, and circularly.

Each Arm
hath nine
Muscles.

It is moved upward by two Erectors, *Deltoides* and *Supraspinatus*. First, *Deltoides* (so called, because in shape it resembleth the Greek Letter Delta Δ) springeth nervous and broad from the middle of the *Clavicula*, the top of the Shoulder, and the whole Spine of the *Scapula*, as from so many distinct beginnings. But presently becoming carnous and thick, it grows narrower and narrower in its Progress, till it end in a strong Tendon (carnous without and nervous within) which is

Erectors.

1.

M m 3

inserted

inserted transversely into the middle of the Shoulder-bone, and moves it either upwards, and forward towards the Face, or else backwards, as these or those of its fibres are contracted. And besides its moving of the *Humerus*, it helps also to draw up the *Scapula*.

2. The second is *Supraspinatus*, or *Superescapularis superior*. This arises from the *Basis* of the *Scapula*, and fills up the upper *Interscapulium*, viz. all that cavity that is betwixt its Spine and upper Edge; and passing over the jointing of the *Scapula* with the Shoulder-bone, by a broad and strong Tendon is inserted obliquely into the neck of the latter. Some think this doth not only lift the Arm upward, but help to turn it about also.

Depressors. It is pulled down by *Latissimus*, and *Rotundus major*. *Latissimus* is so called from its largeness; for with its fellow it covereth almost the whole Back. It is called also *Ani Scalptor*, or *Tersor*; because those Offices are performed by the help of this Muscle. It springs by a broad membranous beginning from the hinder Processes or Spines of all the *Vertebrae* of the Back-bone, that are betwixt the sixth of the *Thorax*, and the middle of *Os sacrum*, as also from the upper edge of *Os ileum*: then passing upwards when it is come to that part of the Back, where the Ribs begin to bend, it becometh fleshy, and is carried over the lower corner of the *Scapula*, (from which also it often receives many carnosus Fibres) where becoming narrower, it is inserted into the Shoulder-bone, by a short broad Tendon, between the *Musculus pectoralis* and this that follows, viz.

2. *Rotundus major*, or more properly, *Teres major*. (For *Rotundus* means a thing spherical, but *Teres* long and round like a Thread, as this is.) It springeth carnosus from the whole lower edge of the

the *Scapula*, and is inserted by a short and strong Tendon into the Shoulder-bone, a little below its Neck, and moves it contrary to the *Deltoides*, viz. downward and somewhat backward.

It is drawn forward by *Pectoralis* and *Coracoideus*. *Pectoralis* hath a very large and for the greatest part membranous beginning, arising from divers parts, yet is one and continuous. In its upper part it rises from the middle of the *Clavicula*: in its middle, from the whole length of the *Sternum* and the Cartilages of the Ribs annexed to it; in its lowest, from the Cartilages of the sixth, seventh and eighth Ribs. It presently becomes carnosus and thick, but narrower, and running towards the Shoulder it is inserted into the Shoulder bone, a little below its Head, between the *Deltoides* and the *Biceps* of the Cubit. The Fibres of this Muscle are of three sorts, viz. obliquely descending, straight (or transverse) and obliquely ascending; and accordingly it draws the *Os humeri* either directly forward towards the Breast by its middle straight Fibres, or else obliquely forwards, viz. forward and upward, or forward and downward, as the obliquely descending, or obliquely ascending Fibres are contracted.

Coracoideus or *Coracobrachialis* springeth from the *Coracoideus* Process of the *Scapula*, and endeth about the middle of the Shoulder-bone, assisting the obliquely descending Fibres of the *Pectoralis* in moving that Bone obliquely forward and upward.

It is moved backward by three: *Infraspinatus*, *Subscapularis* or *Immersus*, and *Rotundus minor*. *Infraspinatus* or *Suprascapularis inferior* springeth from the lower *Basis* of the *Scapula*, and filleth up the lower *Interscapulium*, viz. all that space that is betwixt its Spine and lower edge, as the *Supraspinatus*.

spinatus did that between the Spine and upper edge. It is inserted by a broad and short Tendon into one of the Ligaments, that strengthen the jointing of the Shoulder-bone with the *Scapula*.

2] *Subscapularis* or *Immersus* possesseth the whole inner cavity of the *Scapula*. It springeth from the inner part of its *Basis*, fleshy, and so continuing, passeth forward (but becoming still narrower) to the Neck of the *Scapula*, and at the last by a broad Tendon is inserted into one of the Ligaments that strengthen the aforesaid Shoulder-joint.

3. *Rotundus minor* ariseth from the lowest corner of the *Scapula* by a fleshy beginning, and is implanted into the Neck of the Shoulder-bone. Some make but one Muscle of this and the *Rotundus major*.

As to the circular motion of the Arm, that is not performed by any particular Muscle, but several of these contribute towards it, namely the *Supraspinatus*, *Infraspinatus* and *Subscapularis*, and in some measure the others also.

C H A P. XXII.

Of the Muscles of the Ulna.

THE lower part of the Arm from the Elbow to the Wrist is called the Cubit, and consisteth of two Bones, called *Ulna* and *Radius*. The *Ulna* serveth for flexion and extension; but the *Radius* helpeth to turn the Cubit inward or outward, so as to make the back or palm of the Hand look upward or downward.

The

The *Ulna* is bended by two, to wit, *Biceps*, and *Brachia-
us internus*. *Biceps* is so called because it hath two heads, both of which spring from the Shoulder-blade. The one is outward, tendinous and round, springing from the upper brim of the *Acetabulum*, or cavity of the *Scapula*, into which the head of the Shoulder-bone is received; The other is broader, and is framed partly of a Tendon, and partly of Flesh: it springs from the Anchor-like Process of the Shoulder-blade, from whence descending by the inside of the head of the Shoulder-bone, it meeteth with the former, and both together become a strong fleshy Muscle: which lying on the inside of the Arm, afterwards ends in a thick, round, and strong Tendon, which is inserted into the inside of the head of the *Ulna*, (or of the *Radius*, as *Bartholin* will have it.) This Tendon is sometimes pricked in letting blood in the Arm, and then it causeth great Pain.

*Brachia-
us internus* lieth under the *Biceps*, being shorter than it, and altogether fleshy. It riseth where the *Deltoides* endeth, viz. from the middle of the Shoulder-bone, unto which it cleaveth firmly, and is inserted between the heads of the *Ulna* and *Radius*, in their fore-side.

The *Ulna* is extended by four Muscles, *Longus*, *Brevis*, *Brachia-
us externus*, and *Cubitalis*. *Longus* hath two beginnings; the one is partly fleshy and partly nervous, at the lower edge of the *Scapula*, near its Neck, (where it hath a peculiar hollow-ness to receive it:) this descends by the inside of the Shoulder-bone, and when it is come as far as the insertion of the *ani scalptor* (described in the foregoing Chapter) there arises another carnosus beginning towards the outer side, that (according to *Spigelius*) joins with it and makes up one Muscle, which

which is inserted into the inner side of the hinder Process of the *Ulna* called *Olecranon*.

2. *Brevis* ariseth from the hinder part of the Neck of the Shoulder-bone, and endeth in the outer side of the *Olecranon*; namely, in that part of the Elbow that we lean upon.

3. *Brachæus externus* (so called by *Riolanus*, to distinguish it from the *internus*) is placed towards the outside of the Shoulder-bone, and is confounded with the other two, and endeth where they do. This seemeth to be *Spigelius's* second beginning of the *Longus*, which he says grows into one Muscle with it.

4. *Cubitalis* or *Anconæus* ariseth from the lower end and hinder side of the Shoulder-bone, and passing over the Elbow-joint, it endeth by a nervous Tendon in the side of the *Ulna*, a very little below the *Olecranon* or *Ancon*, whence it is called *Anconæus*. Some make one Muscle of this and the *Brevis*.

Note, That the Fibres of both these Benders and Extenders of the *Ulna* keep all a streight course, and so only move the Cubit streightwise.

C H A P. XXIII.

Of the Muscles of the Radius.

The Radius hath four Muscles.

THE *Radius*, the other Bone of the Cubit, is moved accidentally (or in common) by the Muscles of the *Ulna*, to which Bone it is fasten'd; but it has besides, proper motions of its own, and for the performance of these, two sorts of Muscles; of which some are called *Pronatores*, viz. those

those that turn it inwards, and the Palm of the Hand upwards; and others *Supinadores*, which turn it outwards, and the Palm of the Hand downwards.

The *Pronadores* are two in number. The first is, *Pronator superior rotundus* or *teres*. This springeth from the root of the inner knob of the Shoulder-bone at the Elbow, and from the inner side of the *Ulna*, where it is joined to the Shoulder-bone; and running obliquely on the inside of the *Radius* endeth about its middle in a membranous Tendon.

1.

The second is *Pronator inferior quadratus*, which is altogether fleshy. It springeth from the lower and inner part of the *Ulna*, two Inches broad; then marching transversely above the Ligament which joineth the *Radius* to the *Ulna*, it endeth in the inside of the *Radius*. The ending is as broad as the beginning; wherefore it is called *quadratus* or four-square.

2.

The *Supinadores* are in like manner two. The first is *Supinator longus*, so called, because, of all the Muscles which lie along the *Ulna*, it hath the longest Belly. This springeth fleshy from the edge of the outer knob of the Shoulder-bone; and marching obliquely under the *Radius*, is implanted by a membranous Tendon into the upper side of the lower end of the *Radius*, bending somewhat to the inner side.

Two Supinadores.

1.

The second is *Supinator brevis*. This springeth from the outside of the ligament which strengthens the jointing of the *Ulna* with the Shoulder-bone, and from the hinder Process of the *Ulna*, as *Spigelius* describes it; but as others, from the outer Process of the Shoulder-bone; from whence it passeth on obliquely, being without membranous,

2.

membranous, and within fleshy, and is inserted into the middle of the *Radius*.

Note, That though for orders sake we have described the Muscles of the *Radius* next to those of the *Ulna*; yet when one would shew them in dissection, the Muscles of the Fingers, Thumb and Wrist are first to be raised, and then these of the *Radius* after those are taken away.

C H A P. XXIV.

Of the Muscles of the Wrist.

The Wrist
bath four
Muscles.

THE *Carpus* or *Wrist* has three Motions: It is either bended, extended, or moved sideways. For its flexion and extension it has proper Muscles: but as for its motion sideways, that is not performed by any proper Muscles, but by a Bender and an Extender of that side to which it is moved, if they act together. The Benders lie on the inside of the *Cubit*, and the Extenders on the outside.

Two Benders.

1.

The Benders of the Wrist are two; of which the first is *Cubitus internus*: this ariseth by both a fleshy and nervous beginning from the inner tubercle or knob of the *Shoulder-bone*; then passing fleshy the length of the *Ulna* or *Cubitus*, (to which it immediately adheres) it ends by a Tendon, partly nervous, and partly fleshy, in the fifth bone (some say the fourth of the first rank) of the Wrist.

2.

The second is *Radius internus*: this arising from the same tubercle, passes along the *Radius* (adhering to it;) and before it comes to its lower end, turns into a round Tendon, which proceed-

ing forward grows to the transverse Ligament of the Wrist: but still passing further and waxing broader, it is at last inserted into that Bone of the back of the Hand which is set before or sustains the fore-Finger.

The *Extenders* are also two.

The first is *Radiaeus externus*, or *bicornis*: this ^{Two Ex-} ^{tenders.} arises by a double origine from that bony tip of the Shoulder-bone, and from the outer knob of the same: then becoming more fleshy, it passeth along the *Radius* to its middle, where it turneth into a strong Tendon, which presently is divided into two almost round Tendons. Both these pass a little asunder by the *Radius* under the Ligament of the Wrist, and are one of them inserted into that Bone of the back of the Hand which stayeth the fore-Finger, and the other into the Bone which stayeth the middle Finger. 1.

The second is *Cubitaus externus*: this hath its beginning from the root of the external knob of the Shoulder-bone: it passeth along the *Cubitus* or *Ulna*, and when it is come to the Wrist, it endeth in a strong round Tendon, which is inserted into the upper part of that Bone which stayeth the little Finger, not far from the Wrist. 2.

CHAP. XXV.

Of the Muscles of the Palm of the Hand.

THE *Palm* of the Hand is said to have two ^{The Palm} ^{hath two} ^{Muscles.} ^{1.} The first is *Palmaris*, which arises from the inner knob of the Shoulder-bone, round and nervous, but presently becoming fleshy it continues its course along the *Ulna*, under all

all the other Muscles; but about the middle of the said Bone it turns into a round Tendon which passing over the transverse or annular ligament of the Wrist, is afterwards dilated into a broad nervous membrane, which cleaveth firmly to the skin of the Palm of the Hand, (causing it to be of most exquisite sense) and endeth in the inside of the first joint of the Fingers. This Muscle spreading its Tendon thus in the Palm, besides that it adds much to its sensibleness helps to contract and wrinkle the skin thereof, for the taking the faster hold in grasping of a thing.

2.

The second is *caro quædam quadrata*, or a four square fleshy substance: this springeth from the *Membrana carnosa* that covereth that region where the eighth bone of the Wrist is placed. From thence it is carried under the dilated Tendon of the *Musculus palmaris*, to the middle of the Palm of the Hand, and there ends. *Spigelius* says, it is inserted into the outside of the Tendon of the Muscle which moveth the little Finger outwards. It looks as if it consisted of two or three Muscles and serveth (as some think) for the hollowing of the Palm of the Hand, by drawing the outside of it towards the Ball of the Thumb; but according to *Spigelius's* Opinion, it serves rather to withdraw it, and so to spread the Palm open.

C H A P. XXVI.

Of the Muscles of the four Fingers.

THE Fingers are bended, extended, and moved laterally. By the Fingers we mean only the four, excluding the Thumb, whose motion differs very much from that of the other; and therefore we shall describe its Muscles in the next Chapter, as being altogether distinct from these.

The Fingers are bended by three Muscles, (or *Three benders of the Fingers.* rather by six.) The first is called *Sublimis*, or *perforatus*. This springeth somewhat nervous, from the inner knob of the Shoulder-bone, and descends fleshy betwixt the *Ulna* and *Radius* till near the Wrist, where it is cleft into four fleshy portions, which presently pass into so many round Tendons, all whereof are involved together in one common, thin, and mucous Membrane, that they may march the more safely. Thus they are carried under the transverse Ligament of the Wrist, and along the Palm to the second joint of the Fingers (growing there broader and thinner) into which they are inserted, one into each. *Spigelius* notes, That as they pass along the first Joint, they run under a transverse Ligament (that springs from one side of the bone, and is inserted into the other) as under an arch: which Ligament hinders them upon their contraction from starting up out of their places. Near their end each has a Fissure or perforation, to give way to the Tendons of the *profundus* passing through.

The

2. The *second* is named *profundus* or *perforans*. This ariseth from the upper parts of the *Ulna* and *Radius*, a little below the joint of the Elbow, and being cleft at the Wrist into four Tendons, these run (invested in a common Membrane) under the annular ligament of the Wrist, and also the transverse ones of the first joint of the Fingers, and lastly through the clefts of the Tendons of the *Sublimis*, and are implanted into the third joint of the Fingers.

3. The *third* sort of Muscles are called *Lumbricales*, one to each Finger. These are very small, and arising from the Tendons of the *Musculus profundus*, end each in a round Tendon in the first joint of the Fingers, being confounded with the Tendons of those Muscles that move the Fingers laterally; yea sometimes they proceed further along with them by the sides of the Fingers, to the third joint, and assist their lateral motion. The first of these Muscles bends the second joint of the Fingers, the second the third, and the *Lumbricales* the first.

Three Extenders. The Fingers are extended by *three* Muscles, whereof one is *common* to all the four Fingers, and two *proper* to two particular.

One common. The *common* is *Extensor magnus*. This arising from the outer knob of the Shoulder-bone, a little above the Wrist is divided into four Tendons, which passing the Wrist like the foregoing are inserted into the second and third joints of the Fingers. Some make two of this, supposing that Tendon that is inserted into the little Finger, to be the Tendon of a Muscle that is distinct from that from which the Tendons are propagated to the other three Fingers; but grant, it has the same origine, and keeps the same course.

The two proper are one of them called *Indicator*, ^{Two proper} because it belongeth to the fore-Finger. It ariseth from the middle of the *Ulna* on its outside, and by a double Tendon it endeth in the second joint of the fore-Finger: but one of the Tendons becometh one with the Tendon of the *Extensor magnus*. 1.

The other is named *Auricularis*, because it belongeth to the little Finger. It ariseth from the upper part of the *Radius*, and marching between the *Ulna* and the *Radius* it is inserted by a double Tendon into the backside of the little Finger, of which Tendons one coalesces with that of the common Extender. 2.

The Fingers are moved laterally two manner of ways: for either they are brought to the Thumb, or they are carried from it. These Movements are performed by eight Muscles, called *Interossei*, ^{Movers Laterally, eight.} because they are placed between the Bones of the *Metacarpium*. That is, six of them are placed in the three Interstices of the four Bones of the *Metacarpium*, one on the outside of that Bone which sustains the fore-Finger, and another on the outside of that which sustains the little Finger. They are fleshy and round, and spring from the Bones of the *Metacarpium*, to which they also adhere, as they pass along them. When they come to the Roots of the Fingers, they pass into Tendons, which cleave to the sides of the Fingers, and end in the last joint of the Fingers near the root of the Nails. When the Tendons of the *Lumbricales* join with these, they may be reckon'd amongst the Movers of the Fingers laterally, and then there will be twelve in all, the *Lumbricales* being four, and these *Interossei* eight: but usually the *Lumbricales* serve onely to bend the first Joint of the Fingers, as was shewed above.

N n

Besides

*Abducing
Muscles,
two.*

1.

Besides these Muscles, the fore-Finger and the little Finger are said to have each one *proper* Muscle. That of the fore-Finger may either be called *Abducens* in respect of the middle Finger from which it draws it; or *Adducens*, in respect of the Thumb towards which it draws it. It springs from the inside of the first Joint of the Thumb, and ends in the Bones of the fore-Finger, which it pulls towards the Thumb.

2.

That of the little Finger is called *Abductor* (by some *hypothénar*) and springs from the third and fourth bone (of the second rank) of the Wrist, whence proceeding along the palm of the hand, it is implanted by a small nervous Tendon into the outside of the first Joynt of the little Finger, which it draws outwards from the rest.

C H A P. XXVII.

Of the Muscles of the Thumb.

*Two Ex-
tenders of
the Thumb.*

1.

THE Thumb is extended by two Muscles. The *first* is called *Longior*. This ariseth fleshy from the outside of the *Ulna*, near the membranous Ligament which tieth together the *Ulna* and *Radius*. From thence it is carried obliquely upon the *Radius*, and before it come to its *Appendix*, turneth into a round Tendon; which passing under the annular Ligament of the Wrist marcheth along that side of the Thumb, which is next to the fore-Finger, and is inserted into the third bone.

2.

The *second* is named *Brevior*. This ariseth from the same origin with the other, and passeth obliquely above the *Radius*. By one Tendon it is implanted

implanted into the root of the first Joynt of the Thumb, (which answers to the bones of the *Metacarpium* that sustain the Fingers;) the other becoming membranous, cleaveth fast to its second and third bone.

It is bended also by two Muscles; one of which *Two Benders.* springing from the upper part of the *Radius*, is implanted into the first and second Joynt of the Thumb; the other being less, proceeds from that bone of the *Carpus* which sustains the Thumb, lying under the other, and reacheth to the middle of the Thumb. These two are all the Benders acknowledged by *Bartholin*, *Diemerbroeck*, &c. but *Spigelius*, *de hum. corp. fabric.* l. 4. c. 19. describes two which bend the first Joynt, four the second, and one the third. These two which bend the first Joynt, together with the *Abducens* of the same, he says, make the *monticulus pollicis* or ball of the Thumb, or as *Chiromancers* call it *monticulus Lunæ.* *Monticulus lunæ.*

It is moved laterally by two Muscles. The first *Movers laterally, two.* is called *Thenar* (by *Riolanus*) or *Abducens*. This springeth from the inner part of that bone of the Wrist, which stayeth the Thumb, by a nervous beginning: then becoming fleshy, it is inserted into the first Joynt of the Thumb by a membranous Tendon, and draweth it from the fore-Finger. Some make three of it.

The second is *Antithenar*, or *Adducens*, which lieth in the space between the Thumb and fore-Finger. This doth arise from the outside of that bone of the *Metacarpium* which sustaineth the fore-Finger; and being fleshy is inserted into the whole inner side of the first joint of the Thumb, and sendeth a membranous Tendon to the second. This draweth the Thumb to the fore-Finger; Some describe a second *Adducens* arising

from the inner side of the bone of the Wrist that sustaineth the Thumb, and ending in its second joint.

Authors differ very much as to the Number, Rise, and Insertion of these Muscles of the Thumb, which is occasioned partly by their smallness, and partly from their crossing and being entangled one with another, so that 'tis very difficult to trace and raise them.

C H A P. XXVIII.

Of the Muscles of the Thigh.

THE Thigh hath four manner of motions: it is either bended (and that forwards, or backwards) or drawn inward or outward, or moved round.

It is bended forward by two Muscles. The first is called *Psoas*, or *Lumbaris*: this lieth in the inner part of the *Abdomen*, upon the *Vertebrae* of the Loins, &c. It ariseth fleshy from the side of the Bodies and from the transverse Processes of the two lowermost *Vertebrae* of the *Thorax*, and two or three uppermost of the Loins, from whence descending by the inside of *Os ilium*, when it is come to the *Os pubis*, it turns into a round and strong Tendon, which is inserted into the lesser *Rotator* of the Thigh-bone.

The second is *Iliacus internus*: This springeth with a slender and fleshy beginning from the inner Cavity of *Os ilium*, and being joined to the *Psoas* by its Tendon, it endeth before between the greater and lesser *Rotator*.

It is bended backward or extended by the three *Glutæi*, which make up the Buttocks, and serve to go backward withall, or else to raise the Body up streight after sitting. The first which is the greatest, and lieth outmost, is called *Glutæus major*. It springeth very carnosus from the *Coccyx*, from the Spine of *Os sacrum*, and from all the circumference of the *Costa* or edge of *Os ilium*, and is inserted by a strong Tendon four inches below the great *Rotator*. Three Benders backwards.
1.

The second lies in the middle, whence it is called *Glutæus medius*. It springeth from the forepart of the *Costa* and back of *Os ilium* a little lower than the former, and is inserted into the outer and upper part of the great *Rotator*. 2.

The third lies undermost, and is called *Glutæus minor*. It springeth a little lower than the former, (from the outer or backside of *Os ilium*) lying wholly under it, and is implanted into the upper and inner part of the great *Rotator* by a broad and strong Tendon. 3.

It is drawn to the inside by the *Musculus triceps*. This is the thickest of all the Muscles of the Body, and might more justly be called *quadriceps*, seeing it has four beginnings; but they that imposed the name of *triceps*, made a particular Muscle of the first of its four Heads, and called it *Pectineus* or *lividus*. The first Head doth proceed nervous from the upper part of the *Os pubis*, and is inserted into the rough line of the Thighbone. The second springing from the lower side of the same bone, being lesser is inserted a little higher up into the said line. The third arising from the whole lower part of the *Coxendix*, is inserted a little under the lesser *Rotator*. The fourth springing from the *Apex* or tip of the *Coxendix* is implanted into the inner and lower Tu- One Drawer to the inside.

bercle of the Thigh by a round Tendon, which is joyned with the slender Tendon of the first part of this Muscle.

Four turn-
ers to-
wards the
outside.

1.

2.

3.

4.

It is turned towards the outside by four small Muscles called *Quadrigemini*. They are placed behind upon the articulation of the Thigh, one by another. The first is called from its situation *Iliacus externus*, and from its figure *pyriformis*; it is longer than the rest, and ariseth from the outside of the three lowest *vertebræ* of *os sacrum*. The second ariseth from the knob of *os ischium*. The third ariseth from the same part. These three are inserted into that dent that is in the top of the great *Rotator*; or as *Bartholin* says, into that space that is betwixt the two *Rotators*. The fourth is called *Quadrigeminus quadratus*, and is more fleshy and broad than the rest: it lieth two inches distant from the third, arising from the inside of the knob of the *ischium*, and is implanted into the outside of the great *Rotator*.

Two turn-
ers about
obliquely.

1.

2.

It is turned about obliquely by two Muscles called *Obturatores*. The first is *Obturator internus*, this turneth it outward. It ariseth from the inner circumference of the hole that is between the *ischium* and *os pubis*, from whence passing transversely outwards over the *Coxendix*, it is inserted into the aforefaid dent or cavity of the great *Rotator*.

The second is *Obturator externus*: this ariseth from the outer circumference of the said hole, and turning about the neck of the Thigh-bone as about a Pulley, it endeth in the said Cavity of the great *Rotator*, and turneth the Thigh inward.

Note, That though for orders sake we have describ'd the Muscles of the Thigh before those of the Leg, yet the *Dissector* cannot so easily nor conveniently

conveniently raise and shew them, till those of the Leg are first raised and removed.

C H A P. XXIX.

Of the Muscles of the Leg.

THE Leg is made up of two Bones as well as *Five Bends* the Cubit, viz. *Tibia* and *Fibula*; but Anatomists have not distinguished their Muscles like *Legs* those of the *Ulna* and *Radius*, but call them all, the *Muscles of the Tibia or Leg*.

Now the Leg is either bended, extended, or moved obliquely.

There are *five* that bend it. The first is *Longissimus*. This ariseth from the inner knob of *Os Ilium*, and descends outermost just under the skin on the inside of the Thigh, running obliquely over the other Muscles, and a little above the Knee ending in a Tendon, which is inserted under the Knee, into the fore and inner side of the *Tibia*. It is otherwise called *Fascialis*, because it embraces the Muscles that lie upon the Thigh like a *Swaddling-band*; and also *Sartorius*, because it helpeth one to sit cross-legg'd. 1.

The second is called *Gracilis*, and springeth with a nervous and broad beginning at the jointing of the *Os pubis*; from whence it runs down the inside of the Thigh, and is implanted by a round Tendon into the inner side of the *Tibia*, near the insertion of the first, but a little lower. 2.

The third is named *seminervosus*, because it is half nervous and half fleshy; for it arises nervous from the knob of the *Ischium*, and so continues 3.

till its middle where it becomes fleshy, descending on the backside of the Thigh; and when it is come near the Ham, it turns into a round Tendon, which is inserted into the inner side of the *Tibia*, towards the backside, running as far as its middle.

4. The fourth is called *semimembranosus*, because it is half membranous. It proceedeth from the same knob, partly nervous, and partly membranous; and endeth by a broader Tendon than the third in the hinder part of the *Tibia*.

The fifth is called *biceps*, because it seems to have two Heads: for first it ariseth from the same knob of the *Ischium* nervous; and from thence being carried on the outside of the Thigh, about its middle it becometh fleshy, as if it begun there with a second head; from whence descending it is inserted by a notable Tendon into the outer side of the upper Appendix of the *Fibula*.

Five Extenders.

1.

The Leg is extended also by five Muscles. The first is *membranosus*: this proceeding fleshy from the upper part of the spine of *Os ilium*, on the outside of the Thigh-bone near the great Process or *Rotator* turns into a broad membranous Tendon, wherefore it is called *Fascia lata*, for it covereth almost all the Muscles of the Thigh and *Tibia*, and at last is inserted a little below the Knee, into the outer and fore-side of the *Tibia* and *Fibula*.

2.

The second is *Rectus*: this springing from the lower part of the spine of *Os ilium*, and passing with a carnosous and round belly streight down the Thigh before, when it is come to the *Patella*, it ends in a broad and strong Tendon, by which it adheres close to the *Patella*, as if it would end in it; but it passes further and is inserted

into

into the foreside of the *Tibia* a little below the Knee.

The *third* is named *vastus externus* : this springeth from the root of the great *Rotator*, and descending along the outer and foreside of the Thigh endeth a little below the *Patella*, near the same place with the former.

3.

The *fourth* is called *vastus internus* : this ariseth from the root of the lesser *Rotator*, and descending on the inner and foreside of the Thigh endeth a little below the *Patella* with the other. The *Vastus externus* descends on the *outside* of the *veffus*, and the *internus* on the *inside* thereof, whence they have their name.

4.

To these some add a *fifth* Muscle called *Cruureus*, which springeth from the fore-part of the Thigh-bone, between the two *Rotators*, and adhering close thereto in its descent, endeth in the same place with the former.

5.

Note, That these four last Muscles being joined together about the Knee, make one common broad and strong Tendon, by which they involve the *Patella* or Knee-pan, and which being inserted into the *Tibia*, tyes it and the Thigh-bone together like a strong Ligament. *Note* also, That the Muscles which extend the Leg are stronger than those which bend it, that the weight of the Body may be the more firmly upholden when we stand.

There is also a single Muscle called *Popliteus*, *One Mover* or *Subpopliteus*, which moveth the Leg obliquely : *obliquely*. this lieth in the hollow of the Ham, and springeth from the outer knob at the lower end of the Thigh-bone, and is carried obliquely to the hinder and inner side of the Appendix at the upper end of the *Tibia*.

C H A P. XXX.

Of the Muscles of the Foot or Tarsus.

THE Foot is moved according to the motion of the *Tarsus* or *Wrist*, (or as some call it the *Instep*, though that name is more proper to the *Metatarsus* or upper arched part of the Foot.) Wherefore the Muscles that perform these motions, are indifferently called the Muscles of the Foot or *Tarsus*.

Two Benders of the Foot.

1. The Foot then is either bended, extended, or moved sideways, according to the motion of the *Tarsus*. It is bended when it is drawn forwards or upwards. To perform which motion it hath two Muscles. The first is *Tibialis anticus*: this ariseth from the upper Appendices of the *Tibia* and *Fibula*, and cleaving unto the whole *Os Tibia*, about the middle of it it becometh narrower, and turneth by degrees into a Tendon, which passing under the annular ligament of the *Tarsus* or *Wrist* that springs from the lower Appendices of the *Tibia* and *Fibula*, is commonly divided into two; whereof the one is inserted into the first of those bones which are called *innominata*, and the other into that bone of the *Metatarsus* or *Instep* that is set before the great Toe. If the Tendon continue one, then it is implanted into the inner side of this last Bone.

2. The second is *Peronæus anticus*: this ariseth from the outer and upper part of the *Perone* or *Fibula*, and being carried through the fissure of the outer Ankle, it is inserted into that Bone of the *Metatarsus* which sustaineth the little Toe. It descends all along by the outside of the fore-going

going Muscle, and hath sometimes two Tendons.

The Foot is extended when it is drawn downwards or backwards. To perform which motion it hath *three* Muscles. The *first* is called *Gemellus externus*, being reckoned by some for two; also *Gastrocnemius externus*, because it with the following maketh the *Calf of the Leg*, which in Greek is called *Gastrocnemia*. It hath two Heads, the first of which arises in the Ham, from the inner Head of the Thigh-bone, fleshy and broad; from whence it marcheth down by the back and inner part of the *Tibia*, and when it is come to the middle of it, becometh tendinous. The other Head likewise riseth in the Ham, but from the outer Head or Prominence of the Thigh-bone, and passing down by the outward and back part of the Leg, becometh tendinous a little above the former, and joining with it they both grow into one strong, broad, and nervous Tendon, which is inserted into the hinder side of the Heel.

The *second* is called *Gemellus internus*, or *Gastrocnemius internus*, because it lieth under the former; and lastly *Soleus*, from its resembling the *Sole-fish* in shape. It is of a livid colour, springing from the backside of the upper *Appendix* of the *Fibula* by a strong nervous beginning, and growing pretty bulky it continueth so till it hath passed the middle of the *Tibia*, when it becometh narrower, and tendinous; and a little above the Heel it is so united to the Tendon of the former *Gemellus*, that both seem to turn into one, which is inserted into the Heel.

The *third* is *Plantaris*. This springeth from the outer head of the Thigh-bone in the Ham, very small but carnosus; from whence it descends

but

Three Extenders.

1.

2.

3.

but a little way before it ends in a very long and slender Tendon, which joining very closely with those of the two former is fastened to the Heel, but reaches as far as the middle of the soal of the Foot: (*Spigelius* says, as far as the Toes, and is inserted into the first joint of each of them, imitating the *Palmaris* of the hand.) The three Tendons of these three Muscles thus uniting make one most strong and thick Tendon, usually called the *great Cord*; and this being implanted into the Heel makes a wound there so very dangerous.

Two Mo-
vers side-
ways.

1.

The Foot is moved sideways by two. The first is called *Tibialis posticus*, *adducens pedem*, or *Nauticus*, because Sailers use it much when they climb up the Mast. It springeth both from the *Tibia* and *Fibula*, and from the Ligament which tyeth them together; whence descending among the hinder Muscles, near to the inner Ankle it becometh tendinous: then passing by it, it goeth to the soal of the Foot, and is inserted into the under side of that Bone of the *Tarsus* which is next to the *cubiforme*, viz. the third *cuneiforme*. This moveth the Foot inwards.

2.

The second is called *Peronæus* or *Fibulæus posticus*: this ariseth from the upper and hinder part of the *Fibula* or *Perone*, by a nervous and strong beginning; and in its descent becoming fleshy and round, it cleaves to the outside of the *Fibula* having its outer part of a livid colour, but the inner of a red. When it is come to the middle of the *Fibula* it becometh tendinous, and descendeth with the *Peronæus anticus* by the fissure of the outer Ankle, but joins not with its Tendons, for it goes under the soal of the Foot, and is inserted into the root of the first or greatest of the three *Ossa cuneiformia*, that is seated before the great Toe.

Some

Sometimes, though seldom, there is another Muscle, called *Peronæus tertius*, which being very slender accompanies the *posticus* in its whole progress, and is inserted into the same place, assisting its Action, which is, to bend the Foot outwards.

CHAP. XXXI.

Of the Muscles of the Toes.

THE great Toe is moved by its proper Muscles, as the Thumb of the Hand was: but the other four by common, which we will first describe.

They are either extended, bended, or moved obliquely.

The Extenders are two. The first is *Tensor longus*. This ariseth by a nervous and acute beginning from the fore and inside of the upper Appen-
dix of the *Tibia*, and presently becoming carnosus, goeth streight down along the *Fibula*, and being come to the *Tarsus* it is divided into four Tendons, which passing under the annular or transverse Ligament thereof, go each to one of the four lesser Toes, and are inserted into their second and third joint on the upper side. As they run along the backside of the Foot they are tyed one to another by a membranous Ligament, for the strengthening of them.

Two Extenders of the four Toes.

1.

The second is *Tensor brevis*. This lieth under the former, having its beginning from the transverse or annular Ligament of the *Tarsus*, fleshy and broad, and by its four Tendons is inserted into the first joints of the four Toes; (*Spigelius* says, into the second.)

2.

The

Six Benders.

1.

The *Benders* of the four Toes are in like manner two, and four *Lumbricales*. The first is *Flexor longus*, or *perforans*: it lieth under the *Gemelli internus* and ariseth from the upper and hinder part of the *Tibia* by a long and fleshy beginning, and passing down along the *Tibia*, (unto which it cleaveth) when it is past the middle of it becometh tendinous: then running by the inner Ankle, under the Ligament of the *Tibia* and Heel to the Soal of the Foot, it is there divided into four Tendons, which passing through the holes of the *Flexor brevis*, are inserted into the third joint of the four Toes.

2.

The second is *Flexor brevis*, or *perforatus*: it springeth from the under and inner side of the Heel-bone, and when it hath passed the middle of the Foot, it is parted into four round Tendons, which are inserted into the second joint of the four Toes, being perforated to give way to the Tendons of the former Muscle to pass to the third joint.

Lumbricales.

They are also bended by four *Lumbricales* which agree altogether with the *Lumbricales* of the hand both in their use, Figure and Rise. They spring from the Tendons of the two former, small and round, (or rather from the membranous Ligament that incloses them) and are inserted by a small Tendon into the side of the first joint, which they help to bend. The fleshy substance, which riseth with two acute beginnings from the fore part of the lower side of the Heel-bone, and reacheth to the Rise of these Muscles, seemeth much to further their Action, and to afford them their carnosus Substance.

Ten Movers obliquely.

The Toes are moved obliquely by the *Interossei*, which are so called, because they are placed between the bones of the *Metatarsus*. They are

in number, whereas there are but eight in the back of the Hand, because the *Metatarsus* hath one bone more than the *Metacarpus*, there being one to sustain the great Toe as well as the rest; whereas the Thumb hath none. Each of them doth spring from the under side of that bone upon which it is placed, but presently turning to its side, it keeps its course along the interstice of the bones till it arrive at the first joint of the Toe, into the side whereof it is inserted by a short and somewhat broad Tendon. If the inner be contracted, the Toe is moved inwards; if the outer, outwards. But if they both act together, then are the Toes extended. In the four distances between the bones, there are eight such Muscles; at the outside of the great Toe one, and another at the outside of the little Toe. But beside it, the little Toe hath a proper *Abductor* to move it outwards, which arising from the Heel passes on the outside of the fifth bone of the *Metatarsus*, and is inserted into the outside of the first joint or bone of this Toe.

The great Toe hath five peculiar or proper Muscles. The first is *Extensor*: this springeth by a fleshy beginning from the outside of the *Tibia*, where the *Fibula* stands out from it: after a short space it passeth into a Tendon, which running under the annular ligament of the *Tarsus*, and marching along the upper part of the Foot, is inserted into the whole upper part of the great Toe, which it extends.

One Extender of the Pollex or Great Toe.

The second is *Flexor*: this springeth from the upper and back part of the *Fibula*, and descending by the side of the *Flexor longus* to the inner Ankle, it there becometh tendinous, and running

One Bender.

ning with the *longus* under that ligament there which tyeth the lower *Appendix* of the *Tibia* to the Heel, it is inserted into the third or last bone of the great Toe, by one strong Tendon, serving to bend it. But sometimes it is divided into two Tendons, whereof one is inserted as abovesaid, and the other into the second Toe: and when this happens, the *Flexor longus* sends but three Tendons to the three last Toes, and none to the second.

Three Mo-
vers side-
ways.

The *three* following move it sideways: of which the *first* is called *Abducens pollicem*, because it draweth the great Toe from the rest, toward the inside of the Foot. It springeth nervous from the Ligament which tieth together the Heel-bone and the *Talus* (or according to some, from the inner side of the Heel it self) and running forwards on the inside of the Foot, it is inserted by a round Tendon into the outside of the first joint of the great Toe.

2. The *second* is called *Adducens pollicem major*, drawing the great Toe towards the rest. This springeth from the Ligament that ties those two Bones of the *Metatarsus* together which sustain the little Toe and the next to it, and proceeding obliquely over the other Bones is implanted into the inner side of the first joint of the great Toe.

3. The *third* is called *Adducens pollicem minor* (and otherwise *Transversalis* from its running *a-cross* the Foot.) This ariseth from the Ligament that binds the first joint of the little Toe, and passing cross the first bones of the other Toes it ends in the inside of the first bone of the great Toe. Some think this serves onely to tie together the first bones of the Toes (like a Ligament :) But *Casseri-
vius*

rius (who first found it out) says it draws the great Toe to the little one, and so makes the Foot hollow, grasping the ground as it were, when we go in stony and uneven places ; to fix the Foot more firmly.

Let not the Reader wonder, that he meets not in this Discourse of the Muscles, with the ingenious Mr. *Comper's* new discoveries : For besides the new Muscles which he has found out , he differs so very much in his description of the old from former Anatomists, that I have thought it better to refer the Reader to his *Myotomia Reformata*, than to do him any injury by curtailing what is fit to be perused at large by the curious.

Having thus finished our Discourse of the Muscles, I have thought fit to subjoin two Figures, wherein are represented as many of the Muscles as can conveniently be shewn in two postures of the Body. Which I have added, to let Beginners in this Art of Anatomy see the manner of the lying of the Muscles in their natural Situation, and of the running of their Fibres.

Tab. XVIII.

Representeth the Muscles as they lie to view in
the fore-part of the Body.

- a *Sheweth the Frontal Muscle.*
- b *The Temporal.*
- c *The Muscle called Masseter.*
- d *The Mastoideus.*
- e *The Deltoides.*
- ff *The Biceps.*
- g *The Extender of the Wrist.*
- h *The Bender of the Wrist.*
- * *The Bender of the Thumb.*
- i *The Extender of the third Joint of the Thumb.*
- kk *The Pectoral Muscles.*
- llll *The streight Muscles of the Abdomen.*
- mm *The Linea alba.*
- nn *The obliquely descending.*
- oo *The Musculus sartorius or fascialis.*
- pp *The streight Muscles of the Thigh.*
- qq *The Triceps.*
- r *Part of the Membranofus.*
- ff *The Vastus internus.*
- t *The Vastus externus.*





Tab. XIX.

Represents the Muscles as they lie to view in the
hinder part of the Body.

- aa *Shew the Trapezius.*
- b *The Deltoides.*
- c *The Supraspinatus.*
- d *The Infraspinatus.*
- e *The Teres major.*
- f *The Extender of the Arm.*
- g *The Brachialis.*
- h *The outer Extender of the Wrist.*
- i *The other Extender of the Wrist.*
- k *The Musculus radii longus.*
- ll *The Latissimus dorsi.*
- mm *The obliquely descending.*
- n *The Quadratus.*
- oo *The Glutæus maximus.*
- p *The Vastus externus.*
- q *Part of the Membranofus.*
- rr *The Seminervofus.*
- ss *The Semimembranofus.*
- t *The Gracilis.*
- u *The Triceps.*
- x *The Biceps.*
- y *The Subpoplitæus.*
- zz *The Gastrocnemius.*
- a *The Peronæus.*

The End of the Fifth Book.

*The Sixth Book.*OF THE
BONES.

CHAP. I.

Of Bones in general, their constituent and integral parts.

A Bone is called in Greek ὀστέον, from ἵσταναι, to *Bones, their*
stand; for according to Hippocrates, ἡ οὐσία, *name,*
 ὡς ἂν εἴπω, καὶ ὡς ἂν εἴπω, καὶ ὡς ἂν εἴπω, *name,*
 it affords stability, streightness and form to the
 Body.

It may be defined to be a *similar part, most* Definition.
dry, cold, and hard, inflexible, void of sense, af-
fording stabiliment and form to the whole Body.

Bones have been commonly taught to be made *Matter and*
 of the more crass, tartareous or earthy part of *nourish-*
 the Seed in the Womb, and that they are *ment.*
 nourished with the like particles of the Blood, and
 moisten'd with their contained Marrow. And I
 see no reason to recede from this Doctrine, unless
 one would commence *litem de nomine*, brangle
 about a term: for though Women have no true
 Seed, and the Man's being only an active prin-
 ciple of generation, affords nothing of matter to
 the parts of the *Fœtus*, but only impregnates the
Ovum, (as was shewn in B. I.) yet if we will but

grant the name of *Seed* to the humour in the *Ovum*, (which we may do without absurdity) we may continue the old manner of speaking. Now though they are continually nourished, yet towards Manhood, by the increased heat of the Body, the primigenial moisture is so lessened, that the bones through their hardness are not apt to be any longer extended; and so Men cease to grow any higher of stature.

As to the integral and constituent parts of Bones, their *Periosteum* or investing Membrane, their *Substance*, *Pores*, *Marrow*, *Glands*, *Vessels*, &c. Dr *Havers* in his *Osteologia nova*, has far outdone all former Anatomists in his account thereof, which is very worthy the perusal of all that are curious in Anatomy. Thither therefore I refer the Reader, and shall here only exhibit a short Scheme of part thereof. And first as to the *Periosteum* that cloaths them.

Periosteum.

The *Periosteum* (he says) "has two sorts or series of Fibres, the under deriv'd from the *Dura Mater*, the upper from the Membrane of the Muscle that lies upon it: which Fibres lie one upon the other, but are not interwoven one with another.

"The under Fibres run all parallel directly from one end of the bone to the other, and are continued from one bone to another by means of the Ligaments that joyn them together in their articulations, upon which they pass.

"The outer hold the same course with the Fibres of the Muscle from whence they are derived, sometimes streight, sometimes oblique, and sometimes transverse; and when they have run so far as to make up their part of the *Periosteum*, he thinks, they are inserted into the bone, and are succeeded by others from some other

"other Muscles. Some of the Tendons of the
 "Muscles also propagate Fibres to make some
 "part of the *Periofteum* : but others penetrating
 "it are immediately inserted into the bone.

"The inner Superficies of the *Periofteum* sticks
 "as close to the bone as if it were glued to it ;
 "and besides, the *Periofteum* has little *fibrillæ*, or
 "threads continued from it, that enter into the
 "substance of the bone, which give them (proba-
 "bly) some internal sense.

The *Uses* he ascribes to it, are, 1. "To be a te-^{in Uses.}
 "gument to the bones. 2. To convey Spirits in-
 "to the substance of the bones for maintaining
 "their heat, for preserving their sensibility, and
 "to assist in the work of their accretion and nu-
 "trition, by means of the minute Fibres it immits
 "into them. 3. To help to set limits to the
 "growth and extension of the bones ; as the
 "Bark is sometimes observed so to bind young
 "Trees, that it is necessary to open it before
 "they can have the liberty of thriving. 4. It is
 "serviceable in the conjunction of the bones and
 "their epiphyses, (while these are cartilagi-
 "nous) also of the bones which are joyned by
 "sutures or harmony, and in the connexion of
 "the bones and their Cartilages. 5. To joyn
 "the Heads and Tendons of the Muscles fast to
 "the bones ; namely, of such Tendons as do not
 "penetrate it, (as some do not.)

Having done with the *Periofteum*, he comes to ^{The sub-}
 the substance of the Bones, which he describes af-^{stance or}
 ter this manner. He says, "they consist of ^{La-} ^{make of}
 "*mellæ* or Plates lying one upon another, and ^{Bones.}
 "these of small strings or Fibres running length-
 "ways of the Bones, (like as we see in Whale-
 "bone.) Which strings, though some of them
 "run to the very extremities of the Bones, and

“ others approach near to them, do not terminate
 “ there, so as to have distinct ends, but they are,
 “ where they may be thought to terminate,
 “ still continued, and run transversly and as it
 “ were arched, that the strings of one side of
 “ the Bone proceed so as to meet and be united
 “ to those that are propagated from the opposite;
 “ and this at both extremities, that they are a
 “ continuation, though not of the Figure, yet
 “ in the manner of a Ring. Therefore they are
 “ not all of a length, but in every Plate they
 “ fall one shorter than another.

“ In several Bones the *Lamellæ* are disposed di-
 “ versly: In those Bones which have a large Cavi-
 “ ty, they are on every side contiguous and close-
 “ ly united: But in those which have not any
 “ great Cavity, but are altogether spongyous
 “ within, many of the internal *Laminae* are pla-
 “ ced at some distance from one another in all
 “ their length, having betwixt them a cavernous
 “ substance or small bony cells. And so have al-
 “ so those Bones which have a large Cavity, some
 “ of these lesser cells at both their extremities.

*Their
 Pores.*

Next he comes to their *Pores*, and says, “ That
 “ in the Bones whose Plates are contiguous, there
 “ are *Pores* through and between the Plates, be-
 “ sides those which are made for the passage of the
 “ Blood-vessels: And these are of two sorts:
 “ The one penetrate the *Laminae*, and are trans-
 “ verse, looking from the Cavity to the external
 “ superficies of the Bone: The second sort are
 “ formed between the Plates, which are longitu-
 “ dinal and streight, tending from one end of the
 “ Bone towards the other, and observing the
 “ course of the bony strings. The first kind are
 “ formed not only in the first internal *Lamina*,
 “ but in every one, even to the outermost; tho’
 “ the

" the nearer they are to the Cavity , the greater
" is the number of the Pores. And as they pass,
" they do not observe any such order as to lie di-
" rectly one under another to form any continued
" passage from the Cavity to the external Plate.
" The second kind , *viz.* the longitudinal , are
" not to be observed but by good glasses , unless
" it be now and then in some particular Bones.
" By these it is that the medullary Oil diffuses it
" self, and is immediately beneficial to the Plates.
" The other (*viz.* the transverse) are but subor-
" dinate to these , and rather designed for the
" passage of the Marrow into them, than for the
" immediate communication of it to the substance
" of the Bone.

" The *Medulla* contained in the Bones consists *The Mar-*
" (besides the Blood-vessels) of an investing *row, and*
" Membrane, in which are included membranace- *Glands.*
" ous lobules or bags, and in these bags *Vesicula* or
" glandular bladders, very much like the vesicu-
" lar substance of the Lungs. And these glandu-
" lar bladders serve both for the separation of the
" medullary Oil from the Mass of Blood, and for
" the reception and conservation of it. In an hu-
" mane Bone which he had preserved till the me-
" dullar Oil was wholly evaporated , he found
" these *Vesicula* remaining dry, but intire , and
" their substance representing in a manner a
" Sponge. They seem to have Pores or immedi-
" ate passages out of one into another (as have
" also the bags) by which the Oil has a free
" course to the Joints, and Substance of the Bone,
" for whose benefit it was designed. By the strict-
" est enquiry he could never find any thing like
" Ducts (as pass from other Glandules) and in-
" deed these are not here necessary , because
" the Oil is not carried from the glandular Vesi-
cles

cles to any large receptacle, but flows out of the superficies of the Marrow in as many places, as there are transverse Pores in the internal Lamel. The *Medulla* serves to oil the substance of every Bone, which the drier it were, the brittler it would be : It lubricates also their Articulations, and hinders their ends from being worn, or overheated with motion; and it moistens likewise the Ligaments by which they are tyed one to another. But in these two last Uses it is assisted by the Mucilage which is separated by the *Glandula mucilaginosa* (as he calls them) which he has observed in all the Articulations of the Bones, and are of the conglomerate kind, of which more in the next Chapter.

Now the manner of the medullary Oil's insinuating it self through a Bone; and its being dispensed to all the parts of it, is this : It first passes being liquid (as it all is while the Animal is alive) out of the Cavity through the transverse Pores of the first internal *Lamina*, and not having Pores of the same kind directly subjacent in the next Plate to transmit it towards the outside of the Bone, it flows into the longitudinal ones formed between these two (the first and second) Plates, and being carried along in them till it find some transverse Pores in the second Plate, it passes through these, which when it has done, it is again obliged to alter its course to run into and flow along the streight Pores between the second and third *Lamine*. Thus it passes through and between the Plates successively, till it has made its way to the external Plate.

Thus the medullary Oil is dispensed in all the Bones to those Plates which are contiguous, and have no intermediate Cavities to enter
"certain"

"ertain any medullary Glands of their own :
 "But where the Plates stand at some distance (as
 "they do in such Bones as have not any great
 "Cavity) there are the small caverns (above-
 "mentioned) which are capable of containing
 "some medullary Glands, from whence the Plates
 "have more immediately, and without the for-
 "mer method of conveyance, the benefit of the
 "Marrow.

"He divides the *Blood-vessels* of the Bones in- *Vessels.*
 "to *nutritious* and *medullary*. The most conside-
 "rable of the *nutritious* enter at the ends of the
 "Bone, viz. the Artery at one end, and the
 "Vein at the other. The *medullary* commonly
 "enter the sides of the Bones (and that oblique-
 "ly, as the Ureters do the Bladder) both by one
 "Foramen.] There are no *Nerves* that are inserted
 "into them (except into the Teeth) but these
 "only run through the *Periosteum* that invests
 "them.

"Some Bones have *large Cavities* in them, as *Large Ca-*
 "Os *humeri*, and *femoris*, the *Ulna* and *Radius*, *vities, and*
 "Tibia and *Fibula*, the Bones of the *Metacarpus*, *Caverns.*
 "and *Metatarsus*, of the Fingers and Toes, and
 "of the *Os hyoides* : to which may be added the
 "lower Jaw ; though the Cavity compared with
 "the magnitude of the Bone hardly deserves to
 "be styled large. Besides these large cavities
 "which are in the inside of Bones, there are les-
 "ser cells or caverns in their substance, which
 "are found in all the Bones, even those which
 "have a large cavity.] But of these before, when
 "we spoke of the distribution of the Marrow.

Besides the large Cavities and Caverns in the *Superficial*
 "inside or substance of the Bones, most have *super- Cavities*
 "ficial Cavities or Sinus's, which Dr. *Havers* di- *and For-*
 "stinguishes into *Sulci* or Furrows (which are the *amina.*
 "long

long ones) and *Pits*, as he calls the shorter ones. And they have besides, *holes* for the nutritious and medullary Vessels, as was but just now observed.

Prominences, viz.

Apophysis, or

Epiphysis.

On the outside of the Bones there are also to be observed their *Prominences* or *Protuberances*, of which there be two kinds: for it is either a continued part of the Bone jetting manifestly above its plain Superficies, for the more commodious Insertion of the Muscles, &c. and is called *Apophysis*, a *Process*; or else it is like an additional Bone growing to another by simple and immediate contiguity, (and generally softer and more porous than it) and is called *Epiphysis*, an *Appendage*. If the Protuberance of the Bone be round, it is called its *Caput*; under which is the *Cervix*, as in the upper end of the Thigh-bone: If it be flat, it is called *Condylus*: if sharp, *Corone*. Other Protuberances or Processes are named from the similitude they have to other things, as *Styloides*, *Coracoïdes*, &c.

Use.

Their *Uses* are many: for they serve 1. for the firmitude and sustentation of the Body, like beams and pillars in houses: 2. for a defence to some parts; so the Skull defends the Brain, the Ribs the parts contained in the Breast: 3. for progression or walking, of which they with the Muscles are the only instruments: 4. they give shape to the parts of the Body. These are their *general* Uses; as to their *particular* Uses, those will be shewn as we describe them severally.

C H A P. II.

Of the different conjunctions of Bones one to another.

Bones are joyned to one another either by *Articulation* or joyniting; or else by *Symphysis* or growing together.

Articulation is either for *manifest*, or *obscure* *Articulation*. The former is called *Diartrosis*, because the Articulation is loose; the latter *Synarthrosis*, because it is close and compact.

Diartrosis, or that loose joyniting which serves for *manifest* motion, is threefold. First, *Enarthrosis*, ^{1. Diarthrosis.} which is, when a large head of a Bone is received into a deep Cavity, as the Thigh-bone into the Hip-bone. Secondly, *Arthrodia*, which is when the Cavity which receiveth is shallow, and the head of the Bone which is received, flattish: such is the Articulation of the *Radius* with the Shoulder-bone, or of the Shoulder-bone with the *Scapula*. The third is *Ginglymos*; when the same Bone receiveth, and is received. This falleth out three manner of ways. First, when the Bone is received by another, and receiveth the same; this is seen in the Articulation of the Shoulder-bone with the *Ulna*. Secondly, when a Bone receiveth one Bone, and is received by another: which is done in the *Spondyls* or *Vertebrae* of the Back, where the middle Bone receiveth the upper, and is received by the lower. The third is, when the process of the Bone being long and round, is inserted into another upper Bone, and so is turned in the Cavity like an Axle-tree in a Wheel;

Wheel ; so is the second *vertebra* of the Neck joynted with the first.

Mucilagi-
nous
Glands.

Note, That in all these Articulations are placed those *mucilaginous Glands* above-mentioned, first discovered by Dr. *Havers*, and accurately described by him in his *Osteologia nova*, p. 187, &c. from whence take this short account of them. They are of *two* sorts : *some* are *small* and *numerous* in every Joint, which are set thick all over the membrane, excepting where there are any large glands, and they are all of an equal magnitude, so as to render it every where glandulous. But in some parts of the membrane, and in the *Sinus*'s of the bones in the Joints, these Glandules are so conglomerated, as to form *remarkable Glands*, which I reckon as a *second* sort. The colour of these is something transparent, when they are not discoloured with blood-vessels. They are *soft* and *pappy*, but not tender and friable, so that they are not easily broken by compression. They are (as I have said before) *conglomerate*, though they do not consist of several lobules or bags of lesser glandules, as some other glands do ; but of several membranes superstrated one over another, set thick with small round bladders, which not only lie contiguous, but tenaciously adhere one to another, as the several membranes likewise do.-----By the pores of these little bladders the mucilaginous liquor is percolated and distinguished from the rest of the mass of blood, which is conveyed to them by the Arteries, and from them it flows into the interstices of the Joints by the excretory passages, which all these glandules have. The *figure* of the Glands is various, and accommodated to the *sinus* or cavity, in which they are seated. Their *situation* is different in the several Joints ; and is, in general, such,

such, that they cannot be injured by a compression from the bones; and yet there is this contrivance, that the bone does either in the inflexion, or extension of the Joint lightly press upon them, so as to promote the excretion of the humour, which they separate, into the Joints, when they are moved and stand most in need of it.] A more particular account of the situation (and *number* also) of these large mucilaginous Glands shall be given, when we come to speak of the particular Articulations.

Synarthrosis or Articulation for *obscure motion*, is such as that of the Ribs with the *Vertebra*, &c. 2. *Synarthrosis*.

Bones grow together either without some middle heterogeneous substance, or with it. *Without* Symphysis. some middle substance they are joyned three manner of ways. First, by a simple line, as the Bones of the upper Jaw and Nose; this is called *Harmonia*. Secondly, by a suture, (or *Rhaphe*) as the Bones of the Skull. Thirdly, when one Bone is fastned in another, as a Nail in Wood; and so are the Teeth fastned in the Jaw bone: this is called *Gomphosis*.

If Bones grow together by a middle substance, it is either by a *Cartilage*, as the Share-bones are joyned; which union is called *Synchondrosis*: or by a *Ligament*, and so the Thigh is joyned with the Hip-bone; this is called *Symneurosis*, or more properly, according to *Spigelius*, *Syndesmosis*: or last of all by *Flesh*, and so is the Bone of the Tongue by its Muscles to the adjacent parts; this is termed *Syssarcosis*.

Spigelius reckons two other heterogeneous middle substances by which Bones are united; one when they are joined by a *Tendon*, as the Kneepan

pan to the Thigh-bone and *Tibia*, which union he calls *Syntenosis*; the other by a *Membrane*, as in Infants the Bones of the *Sinciput* with the *O^s frontis*; and this he calls *Synymenosis*.

CHAP. III.

Of the Skull in general.

WHEN all the Bones of the Body are artificially joined to one another and seated in their proper places, the whole structure of them is called a *Skeleton*, from *σκάλλω*, to dry, because they are then void of all moisture.

This *Skeleton* is commonly divided into the *Head*, *Trunk* and *Limbs*.

The *Head* is again divided into the *Skull* or *Scalp*; and the *Face*.

The Skull.
Its Name.

The *Skull* is called in Greek *κεφάλιον*, *Cranium*, because it defends the Brain *tanquam* *κέλυθρον*, like an *helmet*; and in Latine *Calvaria*, *qu. calva capitis area*, because it comprehends all that part of the Head upon which the Hair grows, and which is said to be *bald* when the Hair falls off.

Figure.

Its *Figure* is globous or round, but not exactly, for it bunches out a little before and behind, and is more flat on the sides, so that it is somewhat longish. The more it varies in any particular Persons from this shape, the more preternatural is its figure. Some raise a nice question concerning its shape, whether it be owing to that of the Brain included within it, or whether the shape of the Brain be owing to this of the Skull. 'Tis true, that they answer one to the other in Figure, but whose is owing to the others is needless to enquire;

quire; nor shall we spend time in such a fanciful Dispute.

In an Embryo its *Substance* is membranous, in *Substance*. Infants new-born 'tis bony, but softish and flexible; but it grows harder and harder by degrees (like the other Bones) yet continues spongie in its middle.

It consists of two *Laminae*, Plates or Tables, *Tables* (so called) the outer thicker and smoother, but the inner harder and furrowed on its inner superficies, to give convenient and safe passage to the Vessels that creep through the *Dura Mater*: yea in some places it is perforated for the transit of Vessels from the said *Meninx* to betwixt the *Laminae* for the irrigating of the Pith that lies between them.

Which Pith is called *Diploë*, and is a spongie *Diploë*. and cavernous substance containing a medullar and somewhat bloody juice for the nourishment of the Skull. It is more porous in young Bodies than in old; and in some places of the Skull than in others: for in some the two Tables grow so close together that 'tis hardly discernible.

Diemerbroeck writes that he has sometimes observed (especially in Venereal Persons) a vicious Humour collected in this spongie Pith, which in tract of Time becoming more acrimonious and virulent, has eat through the very Tables, especially the outer which is softer, and caused most tormenting pains in the *Periosteum* and *Pericranium*; yea sometimes the inner also, and so the whole Skull has been perforated.

C H A P. IV.

Of the Sutures of the Skull.

BEfore we come to describe particularly the Bones which the Skull consists of, we will treat in short of their several manners of commissure or connexion one with another, or with those that are contiguous to them, *viz.* the upper Jaw and the three Bones that are common to the Skull and upper Jaw, *viz.* the *Jugale*, *Cuneiforme* and *spongiosum*, and lastly, of these common Bones with those next to them.

Sutures are proper, or common.

Their connexions among themselves and also with these other Bones, are both called *Sutures* (or Seams:) and these are divided into *proper*, or *common*.

Proper Sutures true, or counterfeit.

The *proper* are those which join the Bones of the Skull one with another; and are either (*vera*) *true Sutures*, or (*mendosa*) *counterfeit*.

Three true.

The *true* are when two Bones being mutually indented, close one with the other, as if two Saws were joined together by their Teeth; whence they are called *ferrata*: and these are *three* in number: the *first* is *Coronalis*, which is seated in the fore part, and passeth from one Temple to the other transversely, joining the *Os frontis* to the *Sinciput*. The *second* is *Lambdoides*, opposite to this, resembling the Greek letter Λ *Lambda*. This beginning at the *Basis* of the *Occiput* ascends obliquely to either Ear, and joins the Bone of the *Occiput* to the Bones of the *Sinciput* and Temples. The *third* is *Sagittalis*, which beginning at the top of the *Lambdoides*, comes right forward by the Crown to the middle of the *streit* the

the *Coronalis*, and in Children for some years (sometimes in the adult) it runs to the top of the Nose, dividing the bone of the Forehead into two. *Spigelius* notes that these true Sutures are only in the outward *Lamina*, the inner being joyned only by *harmonia*.

The counterfeit or *mendosa* resemble a line only, and are more properly called *Harmonia* than Sutures. *Spigelius* reckons five of them, others more, but the chief of them are but two. The first passing from the root of the *Processus mammillaris* upwards, with a circular Duct circumscribes the Temple-bone, and descends down again to the basis of the Ear: this Suture joyns the bones of the *Synciput*, *Occiput*, and *Sphenoides* with the Temple-bone, this lying upon those like the Scales upon Fish, whence this Suture is called *Squamosa*. The second runs from the top of this squamous conjunction obliquely downwards towards the Orbit of the Eye, to the beginning of the first common Suture, and joyns this bone above with the bones of the *Synciput*, and below with the bone of the Forehead.

The common sutures are those whereby the bones of the Skull (as also the common bones) are joyned to those which are contiguous to them. And of these by *Diemerbroeck* there are reckoned five. The first is that by which the outer process of the *Os frontis* is joyned with the first bone of the upper Jaw. The second is seated in the outer and lower part of the Orbit of the Eye. The third ascends obliquely from the inside of the Orbit to the top of the Nose. The fourth proceeds obliquely by the middle of *Os jugale*, joyning it (or rather the first bone of the upper Jaw) to the Temple-bone. The fifth, below in the cavity of the Nostrils, tends from behind

hind forwards: *Spigelius* says, this is common to the *Os cuneiforme* with the *Septum* of the Nose.

The uses of the Sutures. The *Sutures* have three uses. The first is to help to stay the Brain from shogging, and its parts from being misplaced in violent motions, by permitting some Fibres to pass through from the *Dura Mater* to the *Pericranium*, (or from this to that) by which the said *Mater* and the Brain invested in it are suspended as it were. The second is to permit the Vapours and Fumes of the Brain to evaporate. And the third, to hinder the Fissures that happen in the Skull from knocks or falls, &c. from extending any farther than through one bone, for they generally stop at the next Suture.

CHAP. V.

Of the proper Bones of the Skull.

Six proper Bones of the Skull. THE Bones proper to the Skull are in number six, one of the Forehead, another of the Occiput, two of the Crown, and two of the Temples.

1. *Os frontis.* First, *Os frontis*, the Forehead-bone. It is bounded by the Coronal and first common Suture, before; and in the sides by the temporal Bones. It is but one in those of ripe age, but double in Children, being divided by a Suture passing down its middle from the Coronal to the Nose.

Its Cavity. Betwixt the *Lamina* of this Bone at the top of the Nose, there is a large Cavity or Cavern, (often two) from whence two holes pass to the Nostrils.

trils. The outer *Lamina* that constitutes this Cavity, makes the upper plane part of the orbit of the Eye, but the inner, on each side above the Eyes forms a buncy protuberance uneven with many jettings out like little Hills. The Cavity is invested with a very thin greenish Membrane, and contains a clammy humour. What its use may be, is hard to say; some think it gives an Echo to the Voice, making it more sonorous; others that it receiveth the odoriferous air drawn in by the Nose, to stay it awhile before it be sent to the Brain. But these seem but vain conjectures.

It hath two holes in the middle part of the Eyebrow, which come from the orbit of the Eye, by *Holes and Pores.* which the first branch of the Nerve of the fifth conjugation of the Brain goes to the Muscles of the Forehead, &c. Besides these more manifest holes, Dr. *Havers* has observed "in this Bone, and in the Bones of the *synciput* at those Angles which meet in the coronal suture, and all along on both sides the *sutura sagittalis*, numerous Pores penetrating into their substance, which he conceives to be *perspiracula*, by which the offensive vapours, which arise and gather within the *Cranium*, do perspire. Which Opinion, says he, may seem the more probable, if we consider how sweats do easily and frequently arise in the Forehead, even when they are not discernable in other parts; to account for which we may reasonably suppose that there is some other way of evacuation, besides what is made from the mass of blood by the cutaneous Glands, which are to be found in any part of the Skin as well as there.

It hath also four *processes*; the greater two are *Processes.* seated at the greater corner of the Eye, and the lesser

lesser two at the lesser, making the upper part of the orbit.

2, 3. Two
Bones of
the Synci-
put.

The Bones of the *Synciput* or Crown are in number two. Before, they are joined with the Bone of the Forehead by the Coronal suture; behind, with the *Os occipitis*, by the *Lambdoides*; on each side to the Temple-bones, by the *Sutura squamosa*; and to one another in the middle of the Crown, by the sagittal Suture. On the outside they are smooth, but on the inside uneven, for they have a great many furrows running along their inner *superficies* for the passage of the Veins of the *Dura Mater*. Their substance is thinner and more rare even in the adult than that of the other Bones (for the better exhalation of vapours) but in Infants that abound with much humidity, they are membranous and soft, hardening by degrees.

4, 5. Two
Temple-
Bones.

Below these on each side are the Bones of the *Temples*. They are joyned in their upper part to the outside of the Bones of the *Synciput* by the *Sutura squamosa*; before, to the process of the first Bone of the upper Jaw; behind, to the *Os occipitis*, by a counterfeit Suture. These Bones are even and thin in their upper part, like a Skale, (and consist but of one *lamina*) but below thick, hard and unequal or craggy; wherefore they are called *Petrosa*.

Each has
two sinus.

They have each two *Sinus*; the outer greater lined with a Cartilage, betwixt the *Meatus auditorius* and the process that makes part of the *Os jugale*; this receives the longer process of the lower Jaw: the inner less, common to it with the Bone of the *Occiput*, placed on the hinder side of the first named Process.

One Appen-
dix, viz.
Styloides.

By these *Sinus* there stands a slender, sharp and longish *Appendix*, from its shape called *Styloformis*,

mis, which in Infants is cartilaginous, but in the adult becomes bony.

Beside this *Appendix* they have three *Processes*, *Three Processes*, two external and one internal.

The *first external* is blunt, thick, and short, a little hollow within, and because it somewhat resembles a Cow's Pap, it is called *Mammillaris*. *1. Processus mammillaris.*

The *second* is carried forward from the *Meatus* of the Ear, and is joined with the first Bone of the upper Jaw, both of them framing the *Os jugale*, of which in the next Chapter. *2.*

The *third*, that is *internal*, is called *Processus petrosus*, and *Os petrosum*, from its hardness and cragginess. It is pretty long, jetting out to the inner *Basis* of the Skull, *within* which it has two Holes, through one of which an Artery, and through the other the auditory Nerve pass to the inner Cavities of the Ear, that are excavated in this Process, namely the *Tympanum*, *Labyrinthus*, and *Cochlea*: and *without* the Skull it hath three holes; the first of which is the *Meatus auditorius*; the second is narrow, short and oblique, near to the first, by which the Jugular Vein enters the inner Cavities; the *third* is seated betwixt the *Processus Mammillaris* and the *Styloides Appendix*, and ends into that passage that goes from the Ear to the Mouth. *3. Petrosus.*

As to the four little Bones that are contained in its first inner Cavity, *viz. Incus, Malleus, Stapes*, and *Os orbiculare*, we have spoken of them before in *Book III. Chap. 23.*

The *Os occipitis*, that makes the hinder and lower part of the Head, is five-corner'd, by two of which corners it is joyned in its upper part to the Bones of the *Sinciput* by the *Lambdoïdes Suture*, by two other in its foresides to the Temple-bones by a counterfeit or squamous Suture, and *6. Os occipitis.*

by its fifth corner to the *Os cuneiforme*. It is but one in the adult, but it consists of four or more in Infants. It is the thickest and most compact of all the Bones of the Skull.

is Sinus.

It is said to have nine *Sinus*, two external, and seven internal. The external are one on each side of its great hole behind, by which the spinal Marrow descends. Of the internal the two largest are those that receive the Protuberances of the *Cerebellum*.

Processes.

It has also five *Protuberances* or *Processes*, four of which are by the sides of the great *Foramen* afore-said, and being all covered with a Cartilage are received into the *Sinus's* of the first *Vertebra*, serving for the articulation of the Head: the fifth is larger than these, ascending inwards from the great *Foramen*, and parting the Protuberances of the *Cerebel*.

Holes.

Lastly, it has five *Foramina*, of which the lowest and largest is that by which the *Medulla oblongata* passes out of the Skull into the *Vertebra*. The rest are less, and are for the transit of the Vessels.

C H A P. VI.

Of the Bones common to the Skull and upper Jaw.

Three common Bones

1. *Os Cuneiforme.*

Lib. 1. de catarrhis, p. 167.

Hitherto of the Bones proper to the Skull: Now follow those which are common to it and the upper Jaw. These are three: First, *Sphenoides* or *Cuneiforme*, the wedge-like bone; so called, quoth *Schneider*, "Not for the propriety of its figure, for it endeth in a blunt point; nor, as

"as many think, only upon the account of *Scissio-*
 "on or cleaving; but especially with respect to
 "an *Arch* (of which this is the *Cuneus* or *Wedge*.)
 "For the Bones of the Forehead, *Synsciput*, Tem-
 "ples and *Occiput* make the sides of the Arch,
 "and this Bone of which we speak, does like a
 "Wedge fill up that space that lies betwixt those
 "rising sides.] Before, it is joined with the Fore-
 "head-bone; behind, to the *Os occipitis*. At the
 sides it doth accompany a good way the *Os petro-*
sum. Above, it doth touch the first, fourth and
 sixth Bone of the upper Jaw; and below, the
 Bones of the Palate of the Mouth by its wing-like
 Processes. It is thick in the middle, but thinner
 at the edges, and in the adult it consists of two
Laminae and a *Diploë*, like the other Bones pro-
 per to the Skull. In Infants it consists of three
 or four.

It has four external Processes, of which two, that *its Proces-*
 are contiguous to the upper Jaw, are called *Pte-*
ses.
rygoïdes, *Aliformes* or Wing-like; and four inter-
 nal also, which with the space betwixt them com-
 pose the *Sella equina* or *Turcica*, upon which the *Sella Tur-*
Glandula pituitaria lieth, that receiveth the pitui-
cica.
 cious excrements falling from the Brain by the *In-*
fundibulum. Of this *Sella* and its subjacent Cavi-
 ty *Schneider* thus writes. "In that *Sinus* that is *Idem ib.*
 "called *Sella equina* a certain Cavity lyeth under *p. 209, &c.*
 "the upper *Lamina* of the *Os cuneiforme*. In the
 "Skull indeed of an Infant, this Cavity is always
 "naturally absent (for in these the Bone in that
 "place is fungous :) But after the Infant is a
 "year old (as *Fallopian* teaches) it begins to be
 "made, and according to the encrease of the
 "Bone is greater or lesser. A thin skin cloaths
 "this Cavity, which is not of a green colour, as
 "*Baubin* teaches; but is very thin, softish and
 "whi-

" whitish——This *Antrum* (or Cavity) and
 " the like are formed by Nature to the end the
 " Skull should not be too ponderous——No-
 " thing but Air is contain'd in it In some
 " Skulls it is wanting.

Holes.

Most of the more ancient Anatomists speak of several *Holes* in this Bone for the transit of such pituitous humours (into the Nostrils or Palate) as fall upon, or are separated by the *Glandula pituitaria*. But as we intimated from Dr. Lower in *Book III. Chap. 5.* there are no such *Holes* in it for that office, but those excrements are resorbed by the Veins, as that Learned Doctor affirms. Yet it hath sundry Perforations for other purposes, *viz.* for the passage of the motory and optick Nerves of the Eye, and of other Nerves for the motion of other parts, as also of Veins and Arteries.

Sinus.

It has divers *Sinus* : Outwardly or below it has one in each wing-like Process, giving room to the *Musculus pterygoïdes* (or *pterygostaphilinus internus* ; (or rather to Dr. Croone's *pterygopalatinus* .) Inwardly or above, it has one large one called *Sella equina*, before described out of *Schneider* : and two or three small ones.

2. *Os cribriforme.*

The second common Bone is *Os cribriforme*, because like a Sieve it hath many holes, by which the filaments of the olfactory Nerves or *Processus mammillares* pass into the Nostrils. It is seated in the middle *Basis* of the Forehead at the top of the Nostrils, and is covered with the *Dura Mater* which accompanies the nervous filaments aforesaid through the holes. It is joyned by the Sutures called *Harmonia* to the *Os frontis*, the second Bone of the upper Jaw, and to the *Cuneiforme*.

On

On its upper side in the middle it has growing *Its Process* upon it a kind of triangular *Process*, like to the *ses*. Comb of a Cock, which is therefore called *Crista Galli*. And opposite to this in its lower side it has another that is thin and hard, dividing the Nose into two parts or Nostrils, the right and the left, and is called *Septum nasi*.

To this *Os cribriforme*, in the cavity of the Nostrils, there adhere two other Bones called *Spongiosa*, *Offa spongiosa*, because they are full of caverns or holes like a *Sponge* or Pumice-stone. But most Anatomists consider them as parts of the *Os cribriforme*, confounding their names one with the other, calling this, *Os spongiosum*, or *cribriforme* indifferently.

The *third common Bone* is (from its shape) called *Os jugale*, or the Yoke bone. This indeed is *3. Os jugale* not truly a distinct Bone, but is made up of one Process of a bone of the Skull, and of another of the upper Jaw: But because it has a distinct name, and is common to the Skull and upper Jaw, as partaking of both, we therefore reckon it for a distinct *common Bone*. I say it is made up of two Processes, of which the hinder is a Process of the Temple-bone that is carried from the *Meatus auditorius* forwards; and the fore one is a process of the first bone of the upper Jaw, that maketh the lower side of the outer corner of the Eye, which reaching backwards meets the other, and is joyned to it by an oblique Suture, and so makes the *Os jugale*.

By which description of this Bone, its *situation* *Its situation* appears to be on each side of the Face betwixt the *Meatus auditorius* and the first bone of the upper Jaw: and its principal use seems to be for defence of the Tendon of the temporal Muscle, and to give rise to one of the Heads of the Muscle *Masseter*. *use.*

C H A P. VII.

Of the upper and lower Jaws.

THUS far of the Bones of the *Calvaria*, or *Scalp*: next follow those of the *Face*, which are the *Jaw-bones* with their *Teeth*; to which we shall subjoyn the *Bone of the Tongue*.

The Jaw-bones are two, the upper and lower. The upper consists of 12. bones.

The *Jaws* are two, the *upper* and *lower*.

The substance of the *upper Jaw*, especially on its inside, is not solid but spongiouse; and unequal, because it is framed of sundry Bones. They are six pair, six in each side. The *first* is almost triangular, seated on the lower side of the outer corner of the Eye, and by its process maketh up the best part of the *Os jugale* as was shewed in the former Chapter. The *second* is a round, little, and thin bone in the inner corner of the Eye, having an hole in its lower part, called *Foramen lachrymale*, upon which the *Glandula* or *Caruncula lachrymalis* resteth, and through which a branch of the fifth pair of Nerves passeth to the inner Membrane of the Nose. The *third* is thin as the former, but quadrangular. It is placed between the two former in the inner-side of the Orbit of the Eye. The *fourth* is called *Os male*, the Cheek-bone, and is the greatest and thickest. This maketh up the greatest part of the Cheek and Palate, and containeth all the upper Teeth in its Caverns. It is joyned above, on that side next the Nose, to the bone of the Forehead, but below with the wedge-like bone; before, with the second bone of the upper Jaw, behind with the third, and last of all with its fellow. Under the Eye it has a hole for the passage of a branch

of

of the fifth pair of Nerves that is bestowed on the Face; and another near the bottom of the Nose, by which an Artery and a Vein pass from the Palate to the Nostrils. The *fifth* is long, hard, and reasonable thick; it with its fellow maketh up the bony part of the Nose. It is joyned with the Cartilages of the Nose below, (to which purpose it is very rough on that side) but to the internal process of the *Os frontis* above. The *sixth* is broad and thin, and (with its fellow) makes the Roof of the Mouth.

Note, that the under-side of the Orbit of the Eye is formed by the first, second, third, and fourth of these bones of the upper Jaw, and the upper-side by the *Os frontis*: only the *Os cuneiforme* makes up a little part in the hinder side of the outer corner. *The Orbit of the Eye, how formed.*

The *lower* Jaw in those of ripe age is but one Bone, but in Children, till they are a year or two old, it consists of two, which are joyned together at the Chin by *Synchondrosis*, and afterwards grow into one. This is moveable, but the upper immoveable. It resembleth in shape the Greek letter ν . *The lower Jaw consists but of one bone.*

At each end of it there are two *processes*, whereof the one from a broad *basis* grows sharp, and is called *Corone*, going under the *Os jugale*, and having the Tendon of the temporal Muscle firmly inserted into it. The *other* may be called *Articularis*, because it serveth for Articulation. This has a long Neck and a longish but flattish Head (or *Condylus*) that is covered with a Cartilage for its easier motion. By this Head it is inarticulated into the larger *Sinus* of the *Os temporis* that is also lined with a Cartilage, and is knit strongly thereto by a membranous Ligament. *Its process.*

This

Cavity.

This Bone has a *cavity* within, especially in the fore-part toward the Chin, which (as Dr. *Havers* affirms) does not contain a marrowy juice for its nourishment, but serves only as a chanel for the Nerve and the blood-vessels to run along in.

Holes.

It has four *Foramina*; of which *two* are at the roots of the Processes, by which a branch of the fifth pair of Nerves together with a Vein and Artery pass to the Teeth (as shall be shewn further in the next Chapter) and *two* other in its fore-part by the sides of the Chin, by which two twigs of the said fifth branch pass out again to the lower Lip and its Muscles and Skin.

Surface.

Its *Superficies* is smooth for the greatest part, but in some places there are asperities for the firmer insertion of the Tendons of its Muscles, as was shewn in the description of those Muscles.

The Alveoli of both Jaws.

Both the Jaws have *Alveoli* or Sockets for the Teeth, in number equal with the number of the Teeth. But when in old age the Teeth fall out, the Sockets close together, so that in time there remains no print of them, but the bone becomes smooth and sharp.

C H A P. VIII.

Of the Teeth.

The Teeth, their name and articulation.

THE Teeth are called in Latine *Dentes*, quasi *Edentes*, from their office of *eating*. They are fixed in their *Alveoli* three manner of ways: the first and chief is by their Articulation with the Jaw-bones, by *gomphosis*; the second is by the Nerve which is inserted into their root, by

by *Synneurosis* ; and the last is by the Gums which cleave to the outside of their roots by *Syffarcosis*.

Their *Substance* is the hardest of all other *Substance*, Bones, but more especially that part of them that stands out naked above the Gums. This part Dr. *Havers* thinks ought to be esteemed rather stony than bony, and yet not the whole of it neither, but only the outside or *cortex*, which like a Shell covers the bony, which being broken off or decayed, the bony quickly rots and moulders away : upon which account it is, that when the Gums are eaten away, so that some part of a tooth, which is not defended with this stony *cortex*, is laid bare, it is eroded ; when that part that naturally stands out of the Gums, and is by such a solid substance secured, suffers no such injury. The stony part is not covered with any *Periosteum* ; but that part which is within the Sockets of the Jaw-bones is invested with a thin Membrane, which he says, " is not the true *Periosteum* (though that invests the Socket wherein they stand) but is propagated from that Membrane that covers the Gums, and is common to the whole Mouth, which does not terminate with the Gums, but when it comes to their extream edge, turns in, and is reflected between the other side of the Gum and the Tooth, descending into the *Alveolus* or Socket, and adhering on one side immediately to those parts of the Teeth which lie within, and on the other to the hard fleshy substance of the Gums, which with this is communicated to the roots of some teeth (especially in the upper jaw) to fasten them more firmly in their Sockets ; and where none of this hard flesh intervenes, it coalesces as it were into one membrane

"brane with the *Perioſteum* that covers the inſide
"of the Socket. By this membrane, and the
Nerve inſerted into the root of every Tooth,
theſe lower parts of the Teeth become exquisitely
ſenſible.

*Cavity and
Veſſels.*

The Grinders have a manifeſt *Cavity* within,
(but the *Incifoſes* and *Canini* but an obſcure one)
whereinto by the very ſmall holes of their roots
they each receive a Capillary Artery from the
Carotides, a Vein from the Jugulars, and a twig
of a Nerve from the fifth pair (as aboveſaid.)
The Vein, Artery, and Nerve are united
together, and clad with a common Membrane
when they enter the Jaw, within which they have
a proper Chanel to run along in under the roots
of the Teeth, ſending twigs to each as they paſs
under them.

Principle.

The Rudiments or *Principles* of the Teeth are
bred with the other parts in the Womb, but lie
hid for ſome Months within the Jaws and Gums.
Theſe Principles are partly bony and partly mu-
cous, and both parts are at firſt included in a
membranous and ſomewhat mucous *Folliculus* or
caſe, which in proceſs of time they break through
(ſome ſooner, others later) their bony part a-
ſcending upwards out of the Gums, and their mu-
cous part (hardening by degrees) deſcending
downward into the Jaw ſo far as there is ſpace
for it; the *Folliculus* it ſelf turning to a kind of
Cement, whereby the Tooth is faſtened to the
ſides of the *Alveolus*.

*Eruption
and growth.*

At what time and in what order they break
forth out of the *Alveoli*, is known to every Nurſe:
omitting therefore to ſpeak of that, I ſhall only
note, That the Teeth alone, of all the Bones in
the Body, continue to grow ſo long as a Man
lives, (and they continue in his Head) for
eſſe

else would they be soon worn to the stumps by their daily use; and we see that when a Tooth is lost out of either Jaw (in the oldest people) that which is opposite to it in the other Jaw, will commonly grow longer than the rest, having none to grind against; though it must be confessed, that the *seeming* length of old people's teeth, is more owing to the falling away of their Gums, than the growth of their teeth.

When Children come to be seven or eight *Change.* years old, they *change* several of their Teeth; but very rarely, if ever, all. The *Incisores* or Fore-teeth, the *Canini*, or Eye-teeth, and the foremost Double-teeth most change; but the rest of the Double-teeth very few. Now concerning this changing of the Teeth, we must know, that the old ones do not come out by the roots, but their upper part only drops off, their root remaining still in the Socket of the Jaw, which (being like Seed for the new ones) by degrees grows up above the Gums to supply the place of that which was fallen off. *Com-* *Dentes* *sapientie.* monly about the twentieth year (or upwards) there spring out two Double-teeth behind the rest, which till then had lain hid in their Sockets. These are called Genuine Teeth, or *Dentes sapientie*, because Men are then come to years of discretion.

As for the *number* of them, commonly there *Number.* are found sixteen in each Jaw; if there fall out any difference in number as to individual persons, it generally falleth out in the *Molares.*

There are *three* ranks or sorts of Teeth. *Sorts.* Those of the *first* rank (or the foremost) are called *Incisores*, Cutters. Most commonly four are found in each Jaw: they have but one

Root or Phang, and so easily fall, or are pulled out. These first make way out of the Gums in Children, because the tops of them are sharpest. Those of the *second* rank are called *Canini*, or Dog-teeth, from their length, hardness and sharpness above the rest. In each Jaw there are two, at each side of the Cutters one. They are otherwise called *Eye-teeth*, either from an Opinion that their roots, (*viz.* of the upper) reach as far as the Eyes, or that the same Nerve that moves the Eye sends a twig to these Teeth; neither of which conceits are true. The roots of these are single as those of the *Incisores*, but they are both sometimes crooked; and if such people in whom they are so, chance to have one of them drawn, they can hardly be pulled out without breaking off a piece of the *Alveolus* in which they are fix'd. Those of the *third* rank are called *Molares*, Grinders; because like Millstones they grind the Meat. Most commonly they are twenty in number, five in each side of both Jaws. The two foremost that stand next to the Dog-teeth, are less than the rest, having but two knobs at the top, but the three hindmost are larger and have four, being in a manner foursquare. The two foremost also have but two roots at most, but the three hindmost commonly three or four. But those of the upper Jaw have for the most part one root more than those which are opposite to them in the lower, or however their roots are larger. The reason whereof may be, first, because they are pendulous, and so are the apter to drop out: and secondly, because the substance of the upper jaw is not so firm as that of the lower.

The

The *use* of the Teeth is principally to chew the *use*. Meat to prepare it for the Stomach, that it may the easilier concoct it into Chyle. The *Incisores* bite off the Morfel, the Dog-teeth break it, and the Grinders make it small; wherefore they are flat in the top, that they may the better receive and keep the Meat; and rough, that they may grind it the better. The Teeth contribute also to the formation of the Speech, especially the Fore-teeth; for those that have lost them, lisp, as we say, and cannot pronounce plainly such syllables as have C, X, &c. in them.

C H A P. IX.

Of the Bone of the Tongue called Os Hyoides.

THE *Os hyoides* is seated at the root of the Tongue under the lower Jaw, and above the *Larynx*. It is shaped like the Greek Vowel *υ*, (whence it is also called *Os Ypsiloides*) or like the lower Jaw, being arched before, and extending its two points or horns backward. *Os hyoides, its situation and shape.*

It is commonly compounded of three Bones. *Paris.* That in the middle is gibbous forwards, and hollow inwards; by its gibbous side it is joyned to the *basis* of the Tongue, and into its concave it receives the *Epiglottis*. The other two are lateral, and are called *Cornua*, or Horns. Each of these has a Cartilage adhering to it; and the middle, two. They are all tied to the adjacent parts, partly by a fleshy, partly by a nervous or membranous substance.

Use.

It serves for the insertion of several of those Muscles that are designed to move the Tongue, (described Book V. Chap. 10.) and also for keeping the Throat open, that the Meat may have passage out of the Mouth into the Stomach, and the Air into and out of the Wind-pipe, while we speak and breath.

CHAP. X.

Of the Bones of the Neck, viz. the Claviculæ and Vertebrae.

Hitherto of the Bones of the *Head*; we should next proceed to those of the *Trunk* (according to our division of the parts of a *Skeleton*;) but betwixt these lieth the *Neck*, whose bones we must describe in our way.

These are of two sorts, to wit, the *Claviculæ* or Chancel-bones, and the *Vertebrae*.

Claviculæ,
their situa-
tion, figure,
substance,
number,
and con-
nexion.

As to the *Claviculæ*, some reckon them to the *Thorax*, others to the Shoulder; but considering their *situation*, they may as fitly be reckoned as pertaining to the Neck. They are called *Claviculæ* from their resembling the shape of old fashioned Keys, which were of the figure of an Italic *s*; such as *Spigelius* says he has seen belonging to old Houses at *Padua*. They are not so crooked in Women as in Men. Their *Substance* is thick and spongie, but more about the heads than about the middle. In *number* they are two, one on each side. Near the Throat they are round; but towards the Shoulder flattish. They are joined to two Bones, to wit, by one end to the

the Shoulder-blade, and by the other to the top of the Breast-bone,

Their *Use* is to uphold the Shoulder-blades, *use*, that they should not slide down upon the Breast together with the Shoulder-bone; which falleth out, when there happens a fracture in these Bones.

The other Bones of the Neck are the *σπονδυλοι*, or *Vertebrae*; but before we come particularly to describe these, it will be convenient to premise something concerning all the *Vertebrae* of the Spine in general.

There are reckoned thirty *Vertebrae* of the *Vertebrae* Spine in all; viz. seven of the Neck, twelve of *of the whole* the Thorax, five of the Loins, and six of *Spine, their* Os sacrum. *Number, Substance, Parts and Holes.* Each consists of a *Body*, that is convex forwards and somewhat hollow behind, but above and below plain: which body is not of a solid and hard substance, but somewhat fungous and softish. This body has three sorts of *Processes* growing out of it toward its hinder side, two transverse, four oblique, and one posterior or acute, which are of an harder substance than it self. There is also a large *proper Hole* in its middle, (or rather betwixt it and its *Processes*) for the descent of the Spinal Marrow: and on its upper and under sides two small lateral *common* ones, that is common to it self and that next it: for one half of these holes is excavated out of the lower side of the upper *Vertebra*, and the other half out of the upper part of the lower; and they serve for the entrance of the Blood-vessels into the Spine, and for the exit of the Nerves that spring out of the same.

The *Vertebrae* are joined to one another *behind* *Connexion*, by *Ginglymus*, forwards by *Harmonia*; on the outside by an hard Membrane, on the inside by a

membranous, hard and strong Ligament, reaching from the first *Vertebra* of the Neck to the *Ossæ sacrum*.

Thus far of what is *common* to all the *Vertebræ*: As for what is *proper* to those of each of the four *Divisions*, that shall be shewn in their particular Description.

*Vertebræ
of the Neck
seven.*

And first for the *Vertebræ* of the Neck, which are in number *seven*. The *Bodies* of these are less, but harder than those of the other, which was convenient because they are more moved. They are not of a semicircular Shape like the other, but rather four-square as it were. Their transverse Processes have each an hole in them, (which the rest have not,) through which Veins and Arteries pass to the Head. Their *posterior* Processes or Spines are forked or cleft into two, except in the first and last *Vertebra*.

1. *Atlas*.

The first or uppermost *Vertebra* is called *Atlas*, because the Head stands upon it, like the Globe of the World. It hath no Spine behind (only a little blunt knob) lest the two small Muscles of the Head (called *Obliqui inferiores*) springing from the second *Vertebra* and inserted into this, should be hurt, when the Head is bowed forward. *Spigelius* says it has no true *Body*, but rather (instead of it) a Tubercle in its fore-side. Both its obliquely ascending and obliquely descending Processes have each a *Sinus* in them: the upper receiving the Tubercles of the *Occiput*, and the lower the ascending Processes of the second *Vertebra*. Upon these the Head is moved forwards and backwards. The substance of this *Vertebra* is harder, solidier, but thinner than that of the rest, because it is the least, and yet its Cavity is biggest. Within on the fore-side of its great *Foramen*, it has a semicircular *Sinus* lined with

with a Cartilage, whereinto it receiveth the tooth-like Proceſs of the ſecond *Vertebra*; round which proceſs (ſays Dr. *Havers*) are ſome mucilaginous Glands planted, and one on each ſide.

The ſecond is called *Vertebra dentata*, becauſe ^{2. Denta-} out of its upper ſide, between its two aſcending ^{ta.} Proceſſes, there ſprings a round, longiſh and hard Proceſs, in ſhape like a *Tooth*, which being inveſted with a Cartilage is jointed into the ſaid *Sinus* of the firſt *Vertebra*, upon which as upon an *Axis* the Head with the ſaid firſt *Vertebra* turns round. And when a luxation happens here, the Neck is ſaid to be broken. This tooth-like Proceſs in that part which enters not into the ſaid *Sinus*, is invironed with a Ligament, by which it is knit to the *Occiput*. The hinder Proceſs of this *Vertebra* is cleft into two, as thoſe of the four following are, for the more convenient inſertion of the Muſcles and Ligaments. Its *transverſe* Proceſſes are leſs than theirs, and have alſo ſmaller holes.

The *four* that lie next under this are in all ^{The other} things like it, ſave that their *transverſe* or ^{five,} lateral Proceſſes are larger, and divided into two as well as the hinder. The *ſeventh* is the largeſt of all. It is liker to the *Vertebra* of the *Thorax* than of the Neck; for neither its *transverſe* nor hinder Proceſſes are cleft like the foregoing, but both are like thoſe of the *Vertebra* of the *Thorax*, to be deſcribed in the next Chapter.

CHAP. XI.

Of the Vertebrae of the Thorax.

IN the next place we come to the Bones of the *Trunk*, which is divided into the *Thorax* and *Abdomen*.

The Bones of the *Thorax* are the *Vertebrae* of the *Back*, the *Ribs* and *Breast-bone*.

Vertebrae
of the Back
twelve.

First, as for the *Vertebrae*, they are *twelve* in number, unto which so many *Ribs* (of a side) answer; there are seldom thirteen of each, but more seldom eleven. Their *Spines* or *hinder Processes* are not divided into two as those of the *Neck*, but are solid and simple. The *transverse* are short and blunt, and have each a shallow *Sinus* for the inarticulation of the *Ribs*; but are not perforated like those of the *Neck*. The *oblique Processes* (which are four, two ascending, and two descending) serve for the articulation of one *Vertebra* with another. The descending are a little hollowed, and receive the (something protuberant) *Heads* of the ascending *Processes* of the next *Vertebra* below them, successively. The fore-part of their *Body* next to the cavity of the *Thorax* is round, or convex; and the hinder part lunated, or concave. On each side they have a smooth *Sinus* for the reception of the heads of the *Ribs*; for into these *Sinus* they are received as well as into those of the *transverse Processes*. As for their *Holes*, they have one large proper one in their middle, which containeth the *Spinal Marrow*; and the one half of two *common* lesser ones, that is, one half on their upper side, and another on their lower, as they join to

to one another, for the egress of the Nerves, and ingress of the Veins and Arteries, as was shewn before in the general description of the *Vertebrae*.

CHAP. XII.

Of the Ribs.

THE second sort of Bones in the *Thorax* are *The Ribs*. the Ribs, which (as was shewn in the former Chapter) are usually twelve in number. *Their Substance* is partly bony, partly cartilaginous; the first serving for firmness and strength, the second for articulation, and the easier motion of the Breast in respiration. The bony Substance towards the *Vertebrae* of the Back is thick and roundish, but towards the *Sternum* flat and thin, and ends in a Cartilage. Within, their bony part is fungous or spongie; whence the Ribs being broken are more readily joined together by a *Callus* than most other Bones. The Cartilages in bigness answer the Bigness of the Ribs: for the bigger Ribs have the bigger Cartilages; and on the contrary. The Ribs in the upper side are blunt or broadish, but in the under sharper. In their lower and inner side they have a furrow that runs along them to receive the intercostal Vessels, the Veins, Arteries and Nerves. On their inside towards the cavity of the *Thorax*, they are cloathed with a *periosteum* underneath the *pleura*, and (according to Dr. *Ruysch*) the vessels run along it, and not between the two skins or membranes which compose the *pleura*.

The Ribs are of two sorts, viz. long or short.

The

Seven Ve-
ræ.

The *long* (otherwise called the *true* Ribs) are *seven* in number (being the uppermost:) These are articulated both with the *Vertebræ* and *Sternum*. Their cartilaginous ends or heads are received into shallow *Sinus's* in the Breast-bone; and their bony heads being covered with a Cartilage are received into the *Sinus's* in the bodies of the *Vertebræ*; and the same heads have each a Tubercle (except the two lowest) that being also lined with a Cartilage, are articulated into the shallow *Sinus's* of the transverse Processes. "In both these Articulations with the *Vertebræ* (Dr. Ha-
vers says) are mucilaginous glands to be found, but the largest is in the lower articulation, and on that side which is next the cavity of the *Thorax*. The articulation into the Breast-bone, is by *Arthrodia*; but that into the *Vertebræ*, by *Synarthrosis*; for the motion of the Ribs at that end is very obscure, as being straitly tyed to the *Vertebræ* by Ligaments.

Note, That the Cartilages of these true Ribs are usually observed to be harder in Women than in Men; which may seem to be for the better sustaining of the weight of their Breasts that lie upon them.

Five No-
thæ.

The *short* (otherwise called *Nothæ* or *Spuriæ*, bastard Ribs) are *five* in number; of which the four uppermost having their Cartilages bending upward and cleaving one to another, are joined before to the lower side of the Cartilage of the seventh true Rib: but the last, which is the least, is loose from the rest, and grows sometimes to the Diaphragm, and sometimes to the *Musculus rectus* of the *Abdomen*, as also sometimes does the lowest of the four next above it. Behind they are joined to the *Vertebræ* of the Back, like as the true Ribs were; only the two lowest, (and some-
times

times the third) are received only into the bodies of the *Vertebrae*, and not into the transverse Processes which here have no *Sinus* for their reception.

The Use of all the Ribs is *first*, to keep the Breast and the upper part of the *Abdomen* distended, that in the former the Heart and Lungs may have free space for their motion; and in the latter, the Stomach and Liver might not be prest upon by the circumjacent parts. *Secondly*, to preserve those parts from external injuries, as from bruises or the like. And *lastly*, to sustain the Muscles that serve for respiration, and to yield to or obey their motions; for if the Breast had been environ'd with one continued Bone, it had not been capable of dilatation in inspiration, nor of contraction in expiration.

C H A P. XIII.

Of the Breast-bone or Sternum.

THE *Sternum* (which is the last bone of the *Thorax*) is seated in the middle of the Breast before, serving as a Breast-plate, and having the cartilaginous productions of the true Ribs articulated into it. It is of a red fungous substance, and in Children almost wholly cartilaginous; only its uppermost part is in them somewhat more bony than the rest, perhaps because one end of the *Clavicula* is joyned into it. In Infants it consists of seven or eight, but after some years they so coalesce one to another, that in the adult it is compounded but of three, and in aged persons it seemeth

The Sternum, its substance.

seemeth but one Bone ; yet it is distinguished by two transverse lines, shewing the former division, which are more conspicuous in the inside than outside.

It consists
of three
Bones and a
Cartilage.

The *uppermost* Bone is thickest and broadest ; it hath in each side a longish Cavity lined with a Cartilage, to receive the heads of the Clavicles : between these in its middle and upper part is a lunated pit called *Jugulum*. It has also a small *Sinus* or Dent on the inside , to give way to the Wind-pipe descending. The *second* Bone is neither so thick nor so broad, yet a good deal longer. It is joined to the former by an intervening Cartilage, and in each side has five or six *Sinus* for the inarticulation of so many of the true Ribs. The *third* is the shortest of all, yet it is broader than the second, unto the lower end of which it is joined. What true Ribs were not jointed into the middle Bone, are received by this. To its lower end is annexed the Cartilage called *Mucronata* or *Ensisformis*, Sword-like. This Cartilage is triangular, about an inch long , and on the outside of it there is formed a Cavity in the Breast, called *Scrobiculus Cordis* or the Heart-pit ; and the gnawing Pains sometimes felt there, *Cardialgia* ; though those Pains are not from any primary Affection of the *Heart*, but of the *upper Orifice of the Stomach*, which lies under this Cartilage, and has the name of *Cardia*, from its great consent with the Heart, (as some derive the reason of its name.)

C H A P. XIV.

Of the Vertebrae of the Loins.

THE Bones belonging to the *Abdomen* (which is the *second* or lower part of the *Trunk*) are these five *Vertebrae* of the *Loins*, five or six of *Os sacrum*, *Os Coccygis* and *Ossa innominata*.

The five *Vertebrae* of the *Loins* are larger than *Vertebrae* those of the *Thorax*, and the lowest of them are *of the Loins* biggest. They are jointed with the last *Vertebra* *five* of the *Back* and the first of *Os sacrum*, and with one another, by an intervening clammy Cartilage, but more loosely than those of the *Back*, because the *Body* bends more upon them. Their *Bodies* are larger than those above them; and among themselves the lower the larger: but they are of a very rare and pumice-like Substance. Their middle and lateral *Holes* are like those of the *Back*, only the larger half of the lateral is excavated out of the lower *Vertebra*, whereas those of the *Back* are formed equally out of both. As for their *Processes*, their *posterious* (or *Spines*) are shorter and more blunt, but broader and thicker than those of the *Vertebrae* of the *Thorax*, and turn something upwards; but their *lateral* are longer. They also differ in their inarticulation one with another; for whereas in those of the *Thorax* the upper (*oblique*) *Processes* were knobby, and the lower hollow, to receive them; in these the contrary is seen; for the upper *Processes* are hollow, and the lower knobby. Onely the last or twelfth *Vertebra* of the *Thorax* has both its ascending and descending oblique *Processes* hollowed,

lowed, to receive the heads or knobs of the Processes of the last but one of the *Thorax*, and of the first of the Loins.

CHAP. XV.

Of the Os sacrum, and Os coccygis or Rump-bone.

Vertebræ
of Os sa-
crum five
or six.

THE *Os sacrum* is the broadest of all the Bones of the Back, and doth sustain all the other *Vertebræ*. On the inside it is smooth and hollow, on the outside convex and uneven, being of something a triangular shape. In its upper part on each side it is knit firmly to the *Ossa Ilii* by an intervening Cartilage. It consists of five or six Bones, plainly distinguishable in Infants, but more obscurely in grown persons. These Bones have the resemblance of (and are usually called) *Vertebræ*, for each of them hath a *Body* and *Processes*, and a large *hole* to receive the *Spinalis medulla*. The Bodies of these differ from those of the other *Vertebræ* in this respect; that whereas in those, the lower part is always bigger, in these it is the less; by which means the uppermost of them is the biggest, and the lowest the least. Their smaller holes which serve for the ingress and egress of Vessels differ also from those of the other, in that they are not in their sides, but before and behind; of which those before are much the larger. As for their *Processes*, the *oblique* can hardly be discerned, except in the first. The *transverse* are pretty long, but so united, that all seem but one. The *hinder* or spines are like those of the Loins, but less, and still the

the lower the lesser; insomuch that the lowest hath no Process, but only a round Protuberance.

To the *Os sacrum* the *Os Coccygis* or Rump-bone *Os Coc-*
is joined by a Cartilage, somewhat loosely, that it *cygis*.
may bend a little backwards in Women in travail
for the freer passage of the *Fœtus*, &c. It is com-
pounded of three or four Bones, of which the
first hath a small hollownes which receiveth the
last *Vertebra* of *Os sacrum*. The rest of its Bones
grow each less than other, so that the lowest ends
in a cartilaginous point. It is called *Os Coccygis*,
because in shape it resembleth the Cuckow's bill.
Its lower end bends inward, to stay the streight
Gut and the Sphincter-Muscle, which are tied to
it. The Bones of it are spongie and soft, and
have neither Process nor any hollownes, for the
spinal marrow descends no further than the bot-
tom of *Os sacrum*.

C H A P. XVI.

Of the Ossa innominata.

AT the lower end of the *Abdomen*, by the *Ossa inno-*
sides of the *Os sacrum*, there stand two *minata*,
large Bones called by *Galen* *Ossa innominata* *their*
(nameless Bones) because they had then no pro- *name*.
per name imposed on them, that he had met with.
But *Spigelius* says, that *Homer* had long before
called them *ἰσχία*, and that they have been gene-
rally, by later Anatomists, known by that name;
(though, by his leave, I think that *Ischium* is
more commonly taken onely for one part of these
Bones called *Coxendix*.) But

*Situation
and Con-
nexion.*

But be their Name what it will, there is one on each side the *Os sacrum*, to which they are joined (through the intervention of a Cartilage) by a most strong Ligament, and together with it frame the *Pelvis*, or that Cavity in which the Womb, Bladder and part of the Intestines are contained.

Parts.

In Children each of them plainly appeareth to be framed of *three* Bones (called *Os Ilium*, *Coxendicis*, and *Pubis*) joined by a Cartilage, until the seventh year; but in Men of ripe Age these three, the Cartilage being dried and hardened into a Bone, seem but one entire Bone. However for the more exact Description of its parts, we must consider it as consisting of *three*.

1. *Os ilium.*

The *first* is called *Os Ilium*, because under it lieth the small Gut called *Ileum*. This is the uppermost and broadest; in figure Semicircular; arched without, within hollow. It is joined with the *Os sacrum* by a common membranous and most firm Ligament, with a Cartilage intervening, as abovesaid.

2. *Coxendix.*

The *second* is called *Os coxendicis*, (or *Ischium*) and in English the Hip-bone: though sometimes both these last names are taken in a larger signification, and include all the three. This Bone is the lower and outer part of the *Os innominatum*, and has a large Cavity in it (called *Acetabulum coxendicis*) which receives the round head of the Thigh-bone, by the articulation called *Enarthrosis*. The brims of this Cavity are tipt as it were with a Cartilage, called its *Supercilium*; and in the bottom of it (according to Dr. *Havers*)
 “there is a *sinus* formed on purpose to receive
 “the large mucilaginous gland lodged there, the
 “greatest of this kind in the whole body. Which
 “*sinus*, he says, is in an humane skeleton almost
 “of

"of an oval figure, which he has found an Inch
 "and five eighths in length, and in the widest
 "place very near one inch one eighth in breadth,
 "and about three eighths of an inch deep; occupy-
 "ing at one end and on both sides only the bot-
 "tom of the *acetabulum*, but at the other end it
 "runs up by the Ligament, which is inserted in-
 "to the tip of the Head of the *Os femoris* to the
 "brim of the Cavity.] Besides this *Sinus* in the
 bottom of the *Acetabulum*, there is another in the
 hinder and inner side of this Bone, in which the
 Muscle of the Thigh called *Obturator internus*
 winds about that part of this Bone (as a Rope
 in a Pulley) according to *Spigelius*. Its lower end
 has a large *Appendix* which we rest or bear upon
 when we sit.

The third Bone is called *Os Pubis*, and *Pectinis*, or ^{3.} *Os pu-*
 the Share-bone. This is the lower and inner or ^{bis.}
 fore part of the nameless Bone, and eaven before is
 joined to its fellow by a Cartilage, which is much
 thicker, but looser and softer in Women than in
 Men; for in the former, one Bone does usually
 recede a little from the other in Travail, to give
 way to the *Fætus*. It has a very large *Foramen*
 between the *Sinus* of the *Coxendix*, and that part
 whereby it is joined to its fellow, making room
 for two Muscles of the Thigh. And above this
Foramen is a *Sinus*, by which the crural Veins and
 Arteries pass to the Thighs.

Note, That the *Pelvis* that is composed by these ^{The Pelvis}
 three Bones and the *Os sacrum*, is bigger in a
 Woman than in a Man, to make the larger room
 for the *Fætus*.

C H A P. XVII.

Of the Scapula, or Shoulder-blade.

The Bones
of the
Limbs.

HAVING done with the Bones of the *Head* and *Trunk*, there remain to be described the Bones of the *Limbs*, which are the *Arms* and *Legs*. The Bones of the *Arms* are either *above* the joint of the *Shoulder*, or *under*.

The Scapu-
la.

Its sub-
stance,
figure, and
connexion.

Above the joint lieth the *Shoulder-blade*, in Greek called ὀμοπλάτη, in Latin, *Scapula*. Some reckon this to the *Thorax* because of its situation, as lying upon its upper and back part: but seeing its principal use seems to be for the sustaining and motion of the *Arm*, we have consider'd it as a part thereof. Its *Substance* is for the greatest part thin, but hard and solid. Its outside is a little arched, and its inside hollow. It is somewhat of a triangular *Figure*, and joined to sundry parts by means of the *Muscles*; which sort of union we called above, *Syssarcosis*. Thus it is joined to the Bone of the *Occiput* by the cucullar *Muscles*, or the first pair of the *Scapula*; to the *Vertebrae* of the *Neck* by the same pair, as also by the second and fourth pairs, &c.

Processes.

It has three *Processes*: of which one is extended along its middle, and is called its *Spine*; and that end of it that by a shallow *Sinus* receives the *Clavicula*, *Acromium*, its point or tip: Another is lower and less than this, and acute, something like a *Crow's Bill*, whence it has the name of *Coracoides*; by others it is called *Ancyroides*, Anchor-like: The last is the shortest, called *Cervix* its *Neck*. In the end of this is a *Sinus* that in its upper part is acute, but in its lower round: this

Cavity

Cavity being but shallow of it self has its brims tipt with a Cartilage, which makes it the deeper, into which the head of the Shoulder-bone is received. Dr. *Havers* says, "there is a considerable mucilaginous Gland joining to the upper brim of this *Sinus* or *Acetabulum*, just by the tendinous origination of the *Musculus biceps* on the foreside of it, which runs downwards upon the Membrane for some way towards the Arm-pit. And on the other side of that origination there is another at a little distance from it.] This articulation is strengthened by very strong Ligaments and Tendons, and is partly hindered from Luxation by the top of the second Process.

The Shoulder-blade hath a three-fold Use. First, it receiveth the *Os humeri* in the *sinus* of its *Cervix*, by the articulation called *Arthrodia*; as it does the *Clavicula* in the *sinus* of its *Acromium* by *Synarthrosis*. Secondly, sundry Muscles spring from the Shoulder-blade, which serve for the motion of the *Os humeri*. Thirdly, it defendeth the Back so far as it reacheth, from external injuries, like a Shield. Use.

C H A P. XVIII.

Of the Os humeri, or Shoulder-bone.

THE Bones of the Arm under the joint of the Shoulder are the *shoulder-bone*, the *Cubit-bones*, and the *Bones of the Hand*.

The *Shoulder-bone* is but one in each Arm, *Os humeri* reaching from the Shoulder to the Elbow. In figure it is round, only a little flattish behind towards the Elbow; of a hard and solid substance.

R r 2

It

It is hollow all along like a Pipe, wherein a marrowy substance is contained.

*Its upper
end.*

Its upper end, that is jointed to the *Scapula*, has a great and round Head, cover'd with a Cartilage, which is received into the Cavity of the *Scapula* by that kind of articulation which is called *Artbrodia*. On the hinder side of this Head there stand two rough and uneven Prominences, (which *Spigelius* reckons for another Head) into which the Ligaments are inserted. And betwixt these two Prominences there is a round and long chink through which the nervous Head of the *Musculus biceps* doth pass.

The lower.

Its lower end is articulated with two Bones, viz. the *Ulna* and *Radius*, by *Ginglymus*, for it both receives them and is received by them, having three Processes and two *Sinus* betwixt them; so that this end resembles a Pulley, whence it is called *Trochlea*. The *Ulna* is jointed with its inmost Process, and the *Radius* with the outmost. On its inside, besides the three foregoing, it has a large Process or Tubercle from whence those Muscles arise that lie on the inside of the Cubit; and another less on its outside, from which those Muscles spring that lie on the outside. On the hinder side of the *Trochlea* there is one deep large Cavity; and on the foreside two small ones, into which the Bones of the Cubit hit, when they are moved backward or forward, and are stopped from being carried further. In the cavity on the hinder side Dr. *Havers* has observed a mucilaginous gland; and another large and fair one, in one of the *sinus*'s which are on the foreside. About the middle of this Bone in the inside, there is an hole through which Vessels pass to the marrowy substance for its nourishment.

C H A P. XIX.

Of the Bones of the Cubit.

THE Bones of the Cubit are two ; to wit, the *Ulna* and *Radius*. Their substance is firm and solid, all but their Appendages. They are near of the same length (but the *Ulna* is the longer of the two) and both are hollow within, containing a marrowy substance. They are in some places rough in their superficies, by reason of their lines that are appointed for the Rise or Insertion of the Muscles.

The *Ulna* (otherwise called *Os Cubiti*, and *Cubitus*) is larger in its upper end that joints with the *Os humeri*, and grows smaller and smaller towards the Hand, ending in a round Tubercle or small Head, with a round *Sinus* in it, (on whose hinder side there grows a small sharp Process, from its shape call'd *Styloides*) receiving one of the Bones of the *Carpus*, to which it is knit by Ligaments, (a Cartilage intervening.) Its upper end is articulated with the *Os humeri* by *Ginglymus*, to which end it has two Processes, one before and another behind. That before, is received into one of the fore *Sinus* of the *Os humeri* (mentioned in the former Chapter) in bending the Elbow-joint : and the hinder upon stretching out the Arm enters into the hinder Cavity of the same Bone behind the *Trochlea*, (by which the Cubit is stayed from further extension than to a streight posture) and is called *Ancon* or *Olecranon*. And at the same end it has also two *Sinus*, the one of which is lateral and external, recei-

ving the Head of the *Radius* ; and the other (which is betwixt its two Processes) one of the Processes of the *Os humeri*, which moves in it as a Rope in a Pulley. As it receives the *Radius* in its upper end, so is it received by it in its lower : but in the midst it bends or recedes a little from it, yet is knit to it by a long Ligament.

2. *Radius*. The second Bone is called *Radius* , and lies on the outside of the Cubit. Its upper end is slenderer, having a round Head , one side of which is received by the *Ulna* ; but its tip has a round shallow Cavity in it , which receives the outer Process of the *Os humeri* , by *Diarthrosis*. Its lower end is thicker and broader , and by a little *Sinus* in its side receives the *Ulna* : and at its extremity it has two other small *Sinus* , for the reception of the little Bones of the Wrist , where the often quoted Author says, “ there are a row
“ of mucilaginous glands, or one of them lying
“ like a ridge of little hills from one side to the
“ other on the back part ; and on the inside there
“ are some also, but not so considerable ; as there
“ are likewise at the bones of the *carpus*, which are
“ like a *finbria*.

C H A P. XX.

Of the Bones of the Hand.

Four sorts
of Bones of
the Hand.

THE Hand is divided into three parts : the Wrist, called *Carpus* ; the distance between the Wrist and Fingers , called *Metacarpus* ; and the *Fingers* themselves.

1. Eight of
the Car-
pus.

The Bones of the *Wrist* are eight in number, placed in two ranks or orders. The upper rank hath

hath four Bones, of which three are so joined together that they seem but one; (these are articulated to the *Ulna* and *Radius* by *Arthrodia*;) but the fourth being the least of all, is placed a little out of its rank on the outside of the third. The *inferiour* hath also four Bones; they are joined to one another by *Harmonia*, but to the Bones of the *Metacarpus* by *Synarthrosis*, having some motion though but obscure. They are firmly knit to one another by both a membranous and cartilaginous Ligament; and besides, by another called *Annular*, which compassing the Wrist, comprehendeth both them and the Tendons of the Muscles which pass to the Fingers.

The *Metacarpus* hath four Bones, they are round, and of a solid substance, but hollow within like a Pipe, being full of Marrow. They are bigger than those of the Fingers: that which answereth to or sustaineth the Fore-finger is thickest and longest, and the rest grow each shorter and slenderer than the foregoing. Between each two a distance is left for the *Musculi interossei* of the Fingers. Both in their upper and lower end they have an *Appendix*; that at the upper end hath a Cavity which receiveth the Bones of the *Carpus*; but that at the lower, a round long head, covered with a Cartilage, which is received by the *Sinus* of the first Bone of the Fingers, to which the Bones of the *Metacarpus* are tied by a transverse Ligament, that lies in the Palm of the Hand.

The *Fingers* (taking in the Thumb) have fifteen Bones, each three. The first are largest, the second less, and the third the least. On the outside they are round, but on the inside plain and a little hollow, that they may lay the firmer hold upon things. Each has an *Appendix*

2. Four of
the Meta-
carpus.

3. Fifteen
of the
Fingers.

(called by some a *Process*) at each end. The *upper Appendices* are round, and those of the first Bones have one round *Sinus* in them whereby they receive the round head of the Bones of the *Metacarpus*: but the upper *Appendices* of the second and third Bones have each two *Sinus*, parted by a small Protuberance. The lower *Appendices* have each two heads divided by a *Sinus*, which are received by the double *Sinus* of the upper *Appendices* of those Bones that join to them: except onely the last or third Bone, which is received by none, but is fenced by a Nail. The second Bone is joined to the first, and the third to the second by *Ginglymus*, and by them the Fingers are onely stretched out and contracted. For as for their motion sideways, that depends only upon the articulation of the first Bones with the Bones of the *Metacarpus*, which is done by *Enarthrosis*, or at least by *Arthrodia*. The jointings of the Thumb answer to these of the Fingers, saving that its *upper Appendix* is not joined to any Bone of the *Metacarpus* (with which it has no communication) but immediately to the Wrist; and its *lower* has but one head, whence the second Bone has but one *Sinus* in its upper Appendix to receive it. In every joint of the Fingers (as also of the Toes) on the inside or bending part, (Dr. *Havers* says, "there are two mucilaginous glands (like a *fimbria*.) One belongs to the remotion, or that which is the moving bone, when the posture of that joint is altered, and is seated just at the end of its extremity: the other is planted upon the bone with which the other is articulated at a little distance from the extreme part of it, up in a *Sinus*, formed as well for the reception of that gland, as to give the other bone, when it moves that way, the liberty

“ berty of sliding towards it, and of being in-
 “ flected, at which time it makes some little
 “ pressure upon it.

Besides these Bones there are in the in-side of ^{4.} *Ossa se-*
 the Hand, at the joynts of the Fingers, some *famoidea*.
 small bones called from their figure and bigness
sesamoidea, like the Grains of *Sesama*, (a sort of
 Indian Corn so called by *Pliny*.) They resemble
 in figure the Knee-pan, and seem to serve for the
 same use; for in strong Extensions of the Fingers
 they strengthen the Tendons of the Muscles upon
 which they are placed, and hinder the luxation
 of the Joynt. Authors differ very much as to
 their number; because being so small they are
 seldom all found; but most agree upon the num-
 ber of 12 to each Hand, placing them thus. At
 the joynting of the second bone of the Thumb
 with the first there are two. The second and
 third joynt of the fore-Finger have each one; but
 its first joynt, as also the first of the other three
 have each two. In Children they are of a carti-
 laginous substance, but grow bony by degrees,
 (being invested with a Cartilage) yet not solid
 but fungous or porous.

C H A P. XXI.

Of the Thigh-bone, and Patella.

THE *Leg* (in a large sense) is divided into
 three parts, the *Thigh*, the *Shank* (or *Leg*
 strictly so called) and *Foot*.

The *Thigh* hath but one Bone: but of all *Os femo-*
 others it is the longest and thickest. *Before*, it is ris-
 round: but *behind*, something depressed, and
 hellow.

hollow. In the *upper* part it has a round head; the slender part under this is called its Neck, and is pretty long and oblique. The Neck is an *Apo-physis* or Process to the Bone it self, and the round Head an *Epiphysis* or Appendix to the Neck. This Head is received by the large Cavity or *Acetabulum* of the *Coxendix*, and is detained therein by two strong Ligaments; one that encompasses the brims of the *Acetabulum*, and another that springs out of its bottom, and is inserted into the tip of this round Head or *Appendix*. At the lower end of the Neck, there spring two Prominences from the Bone; which, because the Muscles called *Rotatores* are fastened to them, are called *Trochanteres*. The hinder and lower is the lesser *Trochanter*; and the lateral or uppermost, the bigger. The *lower* end of the Thigh-bone growing thicker by degrees hath two pretty large Heads, leaving a Cavity in the middle that receiveth the *Apophysis* of the *Tibia*, (which is tied therein by a Ligament, as the upper head of this bone is into the *Acetabulum* of the *Coxendix*;) And again these are received by the Cavities of the *Tibia*, by a loose *Ginglymus*, both the Heads and Cavities being lined with Cartilages. The forepart of this Articulation is called the *Knee*, the hindermost the *Ham*.

Patella.

Upon the Knee appeareth a Bone, not joyned with any other Bone, called the *Pan*, or *Patella*: it is roundish, about two inches broad, plain without, but convex within, and covered with a Cartilage. It is set before the Thigh-bone and the *Tibia*, to strengthen the Articulation; for otherwise the Thigh-bone would be in danger to slip out forward in going down a Hill, or the like. Its substance in Infants new born is soft and cartilaginous, and remains so for many Months; but

but in process of time it becomes bony. It is full of little holes, as all those bones are which pass from Cartilages into Bones. It is involved by the thick Tendons of the second, third, and fourth Muscles that extend the *Tibia*, (and are implanted into its fore knob) whereby it is fixed in its place. The mucilaginous Glands that officiate to this part (the Knee) both before and behind, are lively delineated in a figure of Dr. *Havers's* often quoted *Osteologia*, where the Reader may view them.

Behind there are two *Ossa sesamoidea*, which adhere to the two beginnings of the *Gastrocnemius externus*, (or first Muscle which extends the Foot) to strengthen them.

C H A P. XXII.

Of the Bones of the Leg.

THE *Shank* (or *Leg* strictly so called) is composed of two Bones. The greater is called *ὑψίον*, *Tibia*, the lesser *μεινόν*, *Fibula*. These are slightly articulated into one another near each end; but in their middle they recede one from the other, yet so as they are tied together by a strong membranous Ligament that comes between them.

The *Tibia* (commonly called *Focile majus*) is partly three-square, by its sharp edge before making what we call the Shin. It has an appendix at each end. That above is bigger, and in its upper part hath one Process, which is received by the *Sinus* of the Thigh-bone; and two longish Cavities for the receiving of the two Prominences or Heads of the Thigh-bone, (so that the

Anti-

Articulation is by *Ginglymus*) as was said in the foregoing Chapter. About the brims of these *Sinus* there is joined by Ligaments a moveable Cartilage, soft, slippery, and bedewed with an unctuous humour, from its shape called *Cartilago lunata*, the Moon-like Cartilage. It has also a little Head behind (below the foresaid *Appendix*) which enters into the *Sinus* of the upper *Appendix* of the *Fibula*. Its lower *Appendix* is less than the upper, jetting out with a notable Process towards the inside of the Foot, making the *Malleolus internus* or inner Ankle. It has two Cavities; one less in its side, by which it receives the *Fibula*; another greater and lower, divided as it were into two by a small Protuberance in the middle, and lined with a Cartilage, receiving the convex head of the *Talus* that lies under it; as the said Protuberance is received by the shallow *Sinus* in the convex head of the *Talus*: the one being articulated into the other by *Ginglymus*, so that the Foot is moved upwards and downwards (or bended and extended) upon this joint.

2. *Fibula*. The lesser and outer Bone of the Leg is called *Fibula* (or *Focile minus*;) it is as long as the former, but much slenderer. This has also an *Appendix* at each end: the upper of which reaches not so high as the Knee, nor is it jointed to the Thigh-bone; but in its inner side has a shallow Cavity which receives the little hinder (or lateral) Head of the *Tibia*, that is seated under its upper *Appendix* which is jointed with the Thigh-bone. The lower *Appendix* of the *Fibula* is received by the *Sinus* of the *Tibia*, and extending its Process to the side of the *Talus*, makes therewith the *Malleolus externus* or outer Ankle, which is lower than the inner.

C H A P. XXIII.

Of the Bones of the Tarsus.

OF the *Foot* (as of the *Hand*) there are three parts, *Tarsus*, *Metatarsus*, and the *Toes*.

The *Tarsus* is the distance between the lower end of the two *Focils*, and the beginning of the five long *Bones* which sustain and are articulated with the *Toes*. Some call it the *Instep*, but we have in the former Book (of the *Muscles*) named it the *Wrist*, supposing that by the *Instep* the *Metatarsus* is rather understood.

It hath seven *Bones* much differing from one another in bigness and shape.

The first is called *Talus* or *Astragalus* (in English the *Ankle* or *Huckle-bone*.) This is of a various figure: *Above*, it has something a convex head with a shallow *Sinus* in it, articulating with the *Tibia*, as is described in the foregoing Chapter. By the Process of the *Tibia* that makes the inner *Ankle* it is hedged in as it were on the inside, as it is by that of the *Fibula* on the outer. *Before*, it has a long neck, on which grows a round head that enters into the *Sinus* of *Os naviculare*; upon which jointing the *Foot* is moved sideways. Its *binder* side is rough, and in its upper part has a transverse *Sinus* for the receipt of the *Ligament* of the *Tibia*, and in its lower a little descending *Sinus*, by which the *Tendons* of the *Muscles* of the *Foot* pass. *Below*, it has a *Sinus* behind and a *Protuberance* before, by which it is articulated with the *Heel-bone* by *Ginglymus*. Betwixt the *Sinus* and *Protuberance* there is a long and pretty deep *Cavity*, and over against it

The Tarsus hath seven Bones.
1. Talus.

another such in the Heel-bone. In these is contained a mucous substance which moistens the cartilaginous Ligaments that joyn the *Talus* to the Heel-bone, keeping them from drying by continued motion.

2. *Os calcis.* The second Bone of the *Tarsus* is called *os Calcis*, or *Calcaneus*, the Heel-bone, and is the biggest of the seven. It lies under the *Talus*, with which in its upper side it is articulated in the manner just now described. Behind, it receiveth the great Tendon called *Nervus Hectorus*, (or the great Cord) composed of the Tendons of the three Muscles that extend the Foot. Its fore end is received by the *Os cubiforme*. On its inside it has a large *Sinus*, by which the Tendons and larger Vessels descend to the under-side of the Foot; and on its out-side it is uneven with several knobs, for the firmer connexion of the Ligaments and Tendons.

3. *Os naviculare.* The third is called *Os naviculare* or *Cymbiforme*, from its figure. Behind, it receiveth the *Talus* in a large *Sinus*; but before, it is convex, with three flattish smooth heads that are admitted into the very shallow *Sinus* of the three *Ossa cuneiformia* to be described presently.

The remaining four are less than the three already described, and stand all in one rank; the first of them articulates with the Heel-bone, the other three with the *Os naviculare*. There is no Cartilage betwixt them, but they are knit one to another on the out-side by a cartilaginous Ligament; and are cover'd both in their hinder and fore-part with a smooth Cartilage where they are joyned with other bones. The first is called *Cubiforme* or Die-like, having six sides. This is bigger than the other three that follow; and is seated on the out-side of the Foot. In its fore-side it is

is joyned to the fourth and fifth bone of the *Metatarsus*; in the *binder* with the Heel-bone; and in the *in-side*, to the third bone of the *Cuneiformia*: but its other three sides, *viz.* the *outer*, *upper*, and *lower* are joyned to none.

The three ensuing are called *Cuneiformia*, or ^{s. Three} wedge-like Bones; for above they are thick, and below thinner, so that being joyned they all of ^{Cuneiformia.} them represent a Vault, being convex on the upper-side, but on the under hollow; in which hollowness the Tendons and Muscles are lodged, so that one does not press upon and bruise them in going. The first of these Bones is the greatest, seated in the in-side of the Foot; the second is the least, placed in the middle; the third is in the mean between both in bigness, and stands next to the *Cubiforme*. These three, *behind*, are joyned to the *Os naviculare*, and *before* to the three first Bones of the *Metatarsus*.

C H A P. XXIV.

Of the rest of the Bones of the Foot.

THE *Metatarsus*, or Instep, hath *five* Bones; ^{The bones of the Instep five.} for one is appointed for the sustaining of the great Toe, as well as others for each of the rest: though in the Hand it is not so, where the Thumb has no bone in the *Metacarpus* answering to it.

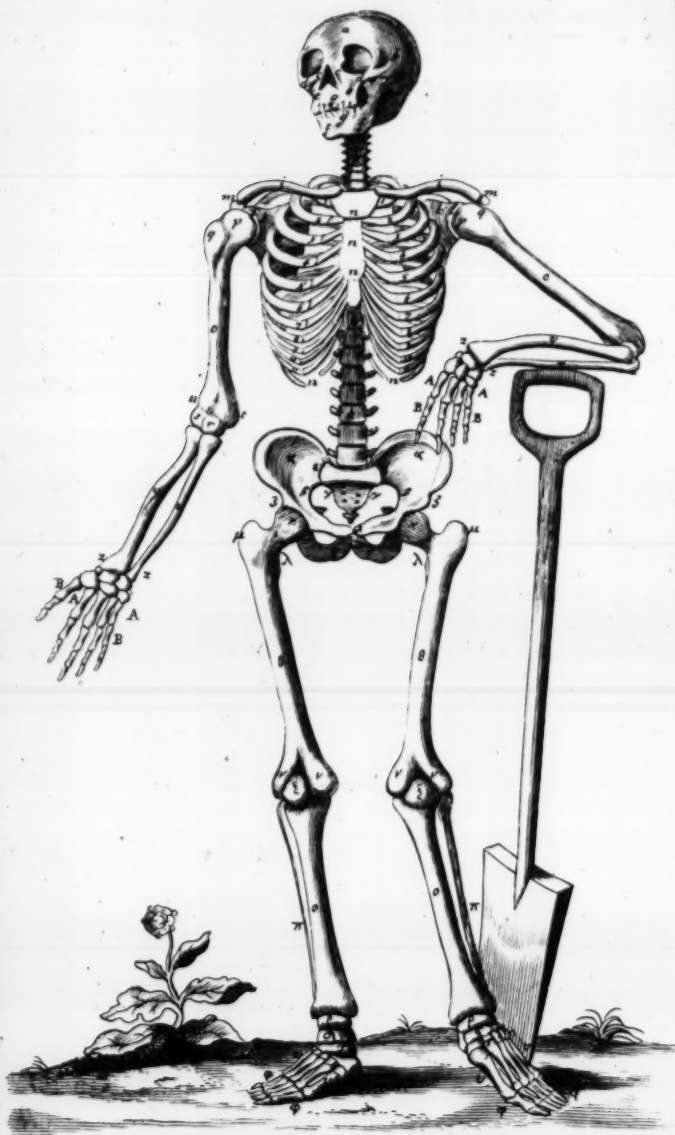
Their substance is very hard and solid, but they are hollow within like so many Pipes, and are longer than the bones of the back of the Hand. That which stayeth (or is articulated with)

with) the great Toe is thickest, but the longest is that which stayeth the next Toe: the other three grow each shorter than other, but are almost of an equal thickness. Their lower ends being round are inserted into the *Sinus* of the first joynts of the Toes: but the upper in their own shallow *Sinus* receive the Bones of the *Tarsus*.

*Of the Toes
fourteen.*

The Bones of the *Toes* are in number *fourteen*; for the great Toe hath only two, but the rest three. These Bones are solid without, and hollow within like those of the Instep. Their Articulation is altogether like that of the Fingers, so that we shall not need here to describe it over again. And the mucilaginous Glands are likewise the same.

Each Foot has twelve *Ossa sesamoidea*, as well as the Hands; which agreeing both in shape and situation with one another, the Reader may be satisfied concerning these of the Feet in the description of those of the Hand in Chap. XX.



Tab. XX.

Representeth the *Skeleton* of an adult Body on its
fore-side.

- a *The Os frontis.*
- b *The Os temporis.*
- cc *The two bones of the Nase.*
- dd *The Ossa jugalia.*
- ee *The bones of the upper Jaw.*
- ff *The lower Jaw.*
- gg *The Teeth in both Jaws.*
- hhhh *The Vertebrae of the Neck, Thorax, Loins and
Os sacrum.*
- ii *The Claviculae.*
- kk *The Scapulae.*
- ll *Their first Process which articulates with the Os
Humeri.*
- mm *Their second called Acromium.*
- nnn *The Bones of the Sternum.*
- oo *The Os Humeri.*
- pp *Its upper and inner head that articulates with the
Scapula.*
- qq *Its upper and outer head which serves for the im-
plantation of Ligaments.*
- r *The inner head of its lower Appendix which receives
the Ulna.*
- s *The outer head of the same Appendix which receives
the Radius.*
- t u *The two Tubercles of the Os Humeri : t the in-
ternal, u the external.*
- x *The Ulna.*
- y *The Radius.*
- zz *The eight Bones of the Carpus.*
- AA *The four Bones of the Metacarpus.*

S f

BB The

BB The four Fingers and Thumb, each of which consists of three Bones.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. The twelve Ribs.

αα The Os ilium.

ββ The Coxendix.

γγ The Os sacrum.

δδ The Os pubis.

εε The connexion of the Os ilium and Coxendix with the Sacrum.

ζζ αα The Tubercles of the Coxendix : ζζ The inner, αα the outer.

θθ The Thigh-bones.

ιι The neck of the Thigh-bone.

κκ The upper head of the Thigh-bone that is received into the Acetabulum of the Coxendix.

λλ μμ The two Trochanters : λλ the inner , μμ the outer.

νν The two lower heads of the Thigh-bone.

ξξ The Patella.—

οο The Tibia.

ππ The Fibula.

ρρ The Talus.

σσ Os Naviculare.

ττ The other Bones of the Tarsus.

υυ The five Bones of the Metatarsus.

φφ The fourteen Bones of the Toes.

AN
APPENDIX
TO THE
SIXTH BOOK:

Describing the
CARTILAGES, LIGAMENTS
and NAILS.

CHAP. I.

Of a Cartilage.

AS an *Appendix* to the Doctrine of *Bones* we will add a word or two of the *Cartilages* and *Ligaments* of the Body: because the former come nearest to the nature of *Bones*; and the latter, as they tie several other parts one to another, so especially the *Bones*: and lastly, of the *Nails*, which from their similitude of substance are also conveniently subjoyned to the *Bones*.

A *Cartilage* (or *Gristle*) is a similar part, cold, *A Carti-* dry, and void of sense, flexible, and not so hard as a *lage, what.* *Bone*. But when by age its glutinous particles are dried up, it many times degenerates into a *Bone*.

Note, That though a *Cartilage* be of it self of *why moist,* a dry substance, yet it is always kept moist on its *and insen-*

Superficies by a mucous or slimy humour that bedews it, whereby it is made slippery and fit for motion. *Note* also, that it is an insensible part, because it neither admits of Nerves nor Membranes, by which alone parts become sensible. Which was so ordered by Nature, because otherwise, seeing they are principally seated about the Joynts, all motion would have become painful. This has been the common opinion: But Dr. *Havers* says, that the Cartilages are covered with a Membrane (as the Bones are) which he names *Perichondrium*, (though it be only a continuation of the *Periosteum*) and that from it Fibres pass into the Cartilages themselves, whereby they are made (partly) sensible. Though he thinks the principal use of this Membrane, especially in such Cartilages as are joyned to any of the Bones, is to strengthen their conjunction.

As for the Cartilages of the Eye-brows, Ears, Nose, *Larynx*, &c. we shall not need here particularly to describe them, having done it where we treated of the respective parts; only we will observe in general, that all the Bones in their articulations one with another, (*viz.* such as admit of manifest motion) are covered or lined with Cartilages, for their easier and glibber motion; and sometimes themselves are the *medium* by which Bones are joyned, which articulation is called *Synchondrosis*, such as that of the *Ossa pubis*; others by tipping as it were the brims of the Cavities of the greater Joynts, make the *Sinus* deeper; and others lastly constitute parts themselves, as those of the Ears, *Larynx*, &c.

C H A P. II.

Of a Ligament.

A Ligament is a similar part, cold and dry, of a middle Substance betwixt a Cartilage and a Membrane, appointed for the tying of sundry parts together.

Note, That as it is either harder or softer than is suitable to its proper nature, it acquires the epithets of cartilaginous or membranous respectively: so, that which proceeds out of the top of the Thigh-bone and is inserted into the Cavity of the Coxendix, is called a cartilaginous Ligament, for its hardness; and that which environeth the joint of the Shoulder, is called membranous, from its softness.

Those which tie Bones together are without sense, (for otherwise upon every Motion we should have been in pain:) but those that knit other parts together, (as those that tie the Liver, Womb, &c. to the neighbouring parts) are sensible.

Ligaments are found in several parts of the Body. As first, the Head being moved upon the first and second Vertebra of the Neck, there are four Ligaments to strengthen those Articulations. Secondly, a common membranous Ligament begirts the whole articulation of the lower Jaw with the Temple-bone. Thirdly, the Bone at the root of the Tongue has four, by which it is tied to the neighbouring parts; and the Tongue it self has one strong one on its under side, (otherwise called its *Frænum*) which being too short, or running too near its tip, hindreth its motion. Children

An Enumeration of the principal Ligaments of the Body.

dren being so troubled, are said to be Tongue-tyed, and must have it cut. *Fourthly*, both the Bodies and Processes of all the *Vertebrae* of the Back are knit together by Ligaments, as also are the Ribs with the *Vertebrae* behind, and with the Breast-bone before. *Fifthly*, sundry are to be seen in the *Abdomen*. The first tyeth the *Os ilium* to the *Os sacrum*. The second knitteth the *Os sacrum* to the *Coxendix*. The third and fourth knit the Share-bones together, one of them compassing them circularly, and the other, which is membranous, possessing their very *Foramen*, and sustaining the Muscles in that place. As for the Ligaments of the Liver, Bladder, &c. those were discoursed of when we described those parts in *B. I.* *Sixthly*, in the Arm these appear. 1. Five tie the *Os Humeri* to the Shoulder-blade. 2. The Bones of the Cubit, *Ulna* and *Radius*, are tyed first one to another; secondly, to the Shoulder-bone; and thirdly, to the Wrist by (mostly) membranous Ligaments. 3. There are two sorts of Ligaments at the Wrist; first an annular one, which going quite round the Wrist serves to confirm and make steady the Tendons of the Muscles which pass under it to the Fingers. Some make two of it; and then that on the outside is for the Tendons of the extending Muscles; and the other in the inner side, for the Tendons of the contracting Muscles. The other Ligament of the Wrist arising from the lower Processes of the *Ulna* and *Radius*, embraces and straitly ties together the Bones of the Wrist, and ends in the upper *Appendices* of the Bones of the *Metacarpus*. 4. The Bones of the *Metacarpus* are tyed one to another and to the Bones of the *Carpus* by common Ligaments. 5. The joints of the Fingers are also bound by common Ligaments: and in the Palm
of

of the hand there lies a transverse Ligament that ties the first Bone of the Fingers to the Bones of the *Metacarpus*. *Seventhly*, In the Leg are these. 1. The Thigh-bone is tied to the *Coxendix* by two Ligaments. 2. The lower end of it is tied to the *Tibia* and *Fibula* by six Ligaments. 3. The *Tibia* is joined to the *Fibula* by three membranous Ligaments, *viz.* two common and one proper. 4. The *Tibia* and *Fibula* are joined to the *Talus* by three Ligaments; and there are three other for the strengthening of the Tendons, that pass under them, and confirming them in their places. 5. The *Talus* is tied with the other Bones of the *Tarsus* by five Ligaments. 6. The Bones of the Instep and Toes are tied with such Ligaments as those of the Hand are.

CHAP. III.

Of the Nails.

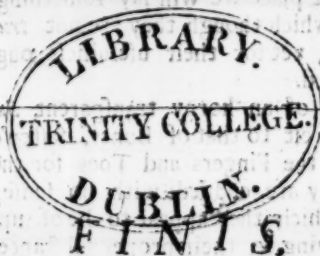
IN the last place we will say something of the *The Nails.* *Nails*, which though they are not truly parts of the Body, yet for their usefulness ought not to be omitted.

They are of an horny transparent Substance, *Their Substance, Colour, &c.* coming nearest to that of Bones, fasten'd upon the ends of the Fingers and Toes for their defence. They are endued with no sense, nor is that colour which they appear to be of upon the Fingers, owing to their proper substance, but to the colour of the parts that lie under them; whence they sometimes look ruddy, sometimes pale, blue or yellow, and thereby give some intimation of the state of the Body. For thus in a swoon

swoon they look pale, because little Blood is then driven into the flesh that lies under them: in a Jaundice they look yellow from the Bile that is mixed with the Blood, &c. They grow very firmly to the subjacent Flesh; and to fasten them the better, they are tied about their root with a Ligament, and on their sides the Skin closes them in. The parts that lie under them are very sensible, for there are several twigs of Nerves and Tendons of Muscles that run to the very Fingers ends; so that upon handling any hard or rugged thing we should have been continually in pain, if these so sensible parts had not been thus defended by the Nails. Which Defence seems to be their principal Use; for their Use to scratch withall is but secondary and less considerable.

In what respect they are Parts of the Body.

They may in some sense be reputed *Parts* of the Body, so as that it would not be perfect and intire without them: but that is but an *improper* Notion of a part. For if they were *properly* parts, they should live by the common Life of the Body: but that they do not, seeing *they* as well as the *Hair* continue to grow after a Man is dead.



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